

SUPPLEMENT.

The Mining Journal, RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

[The MINING JOURNAL is Registered at the General Post Office as a Newspaper, and for Transmission Abroad.]

No. 2571.—VOL. LIV.

LONDON, SATURDAY, NOVEMBER 29, 1884.

PRICE (WITH THE JOURNAL) SIXPENCE
BY POST £1 4s. PER ANNUM.

SILVER MEDAL, ROYAL CORNWALL POLYTECHNIC
Highest Award for Effectiveness in Boring, and Economy in
the Consumption of Air.

JUBILEE EXHIBITION, 1882.

THE PATENT

CORNISH" ROCK DRILL.

FIRST
SILVER

MEDAL,

MINING

INSTITUTE

OF

CORNWALL.

FIRST
AWARD
BORING
CONTEST

DOLCOATH

MINE,

DECEMBER,

1881.

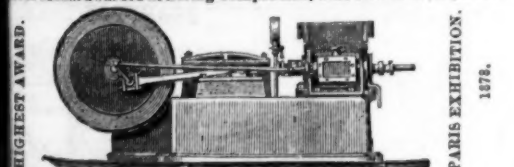


For prices and particulars on application to the Manufacturers,
HOLMAN BROTHERS,
CAMBORNE FOUNDRY AND ENGINE WORKS,
CAMBORNE, CORNWALL.

MINES, AIR COMPRESSORS, TUNNELLING
CARRIAGES, TRIPDS, &c.,
From own design, or to order.

THE PATENT
"CLIPSE" ROCK-DRILL

"RELIAANCE AIR-COMPRESSOR."
Silver Medal awarded at Boring Competition, East Pool Mine, Sept. 1883.



ARE NOW SUPPLIED TO THE
ENGLISH, FOREIGN, AND COLONIAL GOVERNMENTS
And are also in use in a number of the
BEST MINES, RAILWAYS, QUARRIES, AND HARBOUR
WORKS IN GREAT BRITAIN AND ABROAD
FOR ILLUSTRATED CATALOGUE AND PRICES, apply to—
HORN & CO., 22, Charing Cross, London, S.W.

PATENT PULVERIZER.
NEW SYSTEM.



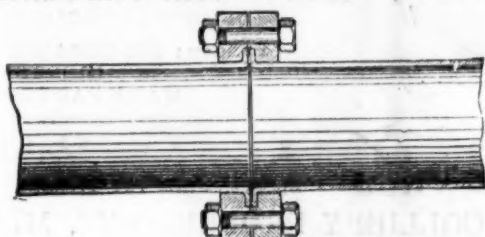
JORDAN, SON, & COMMANS,
62, GRACECHURCH STREET, LONDON, E.C.

HALF-PRICE—ONE SHILLING POST FREE.
A few copies with the covers slightly soiled of the
ENGLISH AND FOREIGN MINING GLOSSARY:
which is added the SMELTING TERMS used in FRANCE, SPAIN,
MANY.
Published at the MINING JOURNAL Office, 26, Fleet street, E.C.;
and all Booksellers.

IMPROVED PATENT
**INGERSOLL
ROCK DRILL**
MEDALS AND HIGHEST AWARDS.

American Institute, 1872.
London International Exhibition, 1873.
Manchester Scientific Society, 1875.
Paris Exhibition, 1875.
Royal Cornwall Polytechnic, 1875.
Rio de Janeiro Exhibition, 1875.
Australia Brisbane Exhibition, 1876.
Philadelphia Exhibition, 1876.
Royal Cornwall Polytechnic, 1877.
Mining Institute of Cornwall, 1877.
Paris Exhibition, 1878.

WROUGHT-IRON STEAM TUBES.



TUBES FOR BOILERS, PERKINS'S, and other HOT-WATER SYSTEMS.

For Catalogues of Rock Drills, Air Compressors, Steel or Iron Steam Tubes,
Boiler Tubes, Perkins's Tubes, Pneumatic Tubes, Boring Tubes, and all kinds of
Machinery and Mining Plant, apply to—

LE GROS, MAYNE, LEAVER & CO.
60, Queen Victoria Street, London, E.C.



The New System for Working Gold,
Stream Tin, and Diamond Alluvials.

THE "BALL PATENT."

9, BUSH LANE, CANNON STREET, LONDON, E.C.

This new system renders River and Placer Marsh Swamps and
Plateau Mining the cheapest of all. No head of water required as
per Californian Hydraulic System. Only a few tons of water wanted
a day.

ABSOLUTELY CLEARS THE LAST PARTICLE ON
BED ROCK OR CLAY BOTTOM.

No fall required for dumping tailings. Depths of rivers, floods, and
other difficulties entirely surmounted. 600 tons a day raised, dis-
persed, washed, and dumped per day for 3d. a ton by smallest plant,
1200 tons by second size plant at 2d. per ton.

See *Mining Journal*, 19th January and 16th February, 1884, on
THE CHEAPEST METHOD OF TREATING AURIFEROUS ALLUVIALS.

NOTICE—TO MINING INVESTORS.

In such esteem is the system held that several extraordinary par-
ticipations in Gold Alluvials are offered simply for the trouble of
putting plant on certain concessions and working it.

Syndicate A completed.

Syndicate B completed.

WANTED, investors in C Syndicate.

Profits are very large, but it is deemed advisable not to publish
them, and they will be only communicated to bona fide enquirers.

SUBSCRIPTION NOW OPEN FOR SYNDICATE C.

Apply by letter first, or personally to above address,
Mondays and Tuesdays, 11 to 2 P.M.

THE
"Barrow" Rock Drill

COMPANY.

HOSKING AND BLACKWELL'S PATENT.



THE DRILLS are exceedingly STRONG, LIGHT, SIMPLE, and adapted for ends
slopes, quarries, and the sinking of shafts. They can be worked by any miner

SUPPLY their CELEBRATED ROCK DRILLS, AIR COMPRESSORS, &c., and
all NECESSARY APPLIANCES for working the said Drills.

Their DRILLS have most satisfactorily stood the TEST of LONG
and CONTINUOUS WORK in the HARDEST KNOWN ROCK in
numerous mines in Great Britain and other countries clearly proving
their DURABILITY and POWER.

About 200 are now at work driving from three to six times the
speed of hand labour, and at from 20 to 30 per cent. less cost per
fathom. They can be worked by any miner.

For PRICES, Particulars and Reports of Successful and Economical
Working, apply to—

LOAM AND SON,
LISKEARD, CORNWALL.

THE PATENT
"Cranston" Rock Drill,
AIR COMPRESSOR, AND DEEP BORING
MACHINERY.

For prices, and particulars of rapid and economical work accomplished, apply to

J. G. CRANSTON,

22, GREY STREET NEWCASTLE-ON-TYNE.

**MACDERMOTT AND GLOVER'S PATENT
PERCUSSIVE ROCK PERFORATOR**
(IMPROVED)

FOR HAND-LABOUR ONLY,

IN HARD ROCK.

FOR MINES, QUARRIES, AND
GOVERNMENT CONTRACT WORK

RATE OF PENETRATION
IN GRANITE,
1½ to 2 inches per minute.

Price £50 complete.

For full particulars, apply to

GLOVER & HOBSON,
ENGINEERS & MILLWRIGHTS,

ALBERT IRONWORKS, ST. JAMES'S ROAD, OLD KENT
ROAD, LONDON, S.E.,

SOLE MANUFACTURERS; OR TO—

M. MACDERMOTT, 25 and 26, Pudding Lane, London.
N.B.—A machine can always be seen at work (without notice) at the Albert
Ironworks. [TELEPHONE 4664.]

JUST PUBLISHED, PRICE 1s.; BY POST, 1s. 1d.

GEOLOGICAL MAP OF CORNWALL:
By BRENTON SYMONS, C.E., F.O.S.

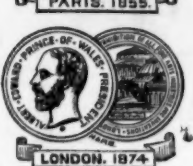
A handsome SKETCH MAP, printed in FIVE COLOURS, and showing the
Geological Formation, the Direction of the Lodes, and other useful details.
Will be forwarded on receipt of remittance.

MINING JOURNAL Office Fleet-street, E.C.

FIRST AWARD.
SYDNEY, 1879.

BICKFORD'S PATENT FUSES

FIRST AWARD.
MELBOURNE, 1881.



SILVER MEDAL OF THE MINING INSTITUTE OF CORNWALL, TRURO, 1880,
for an Improved Method of Simultaneous Blasting.

BICKFORD, SMITH AND CO.,

THE INVENTORS, AND ORIGINAL PATENTEES AND MANUFACTURERS OF
SAFETY AND INSTANTANEOUS FUSES AND IGNITERS

FOR USE IN ALL BLASTING OPERATIONS AND SPECIALLY PREPARED FOR ANY CLIMATE

Note the **TRADE MARK**: Two Separate threads through centre of Fuse.

BICKFORD, SMITH AND CO.'S Patent Igniters and Instantaneous Fuses for simultaneous blasting are being extensively used at home and abroad. This improved method is the cheapest, simplest, and most dependable ever introduced for simultaneously firing any number of charges. For full particulars, see Descriptive Catalogue.

PRICE LISTS, DESCRIPTIVE CATALOGUES, AND SAMPLES TO BE HAD ON APPLICATION.

FACTORIES—TUCKINGMILL CORNWALL; AND ST. HELENS JUNCTION, LANCASHIRE.

HEAD OFFICE—TUCKINGMILL, CORNWALL.
LANCASHIRE OFFICE—ADELPHI BANK CHAMBERS, SOUTH JOHN STREET, LIVERPOOL.
LONDON OFFICE—85, GRACECHURCH STREET, E.C.

Every package bears Bickford, Smith, and Co.'s copyright label.



R. S. NEWALL AND CO.,

Sole Patentees of Untwisted Wire Rope.

Iron & Steel Ropes of the highest quality for Collieries,
Railways, Suspension Bridges, &c.

PATENT STEEL FLEXIBLE ROPES AND HAWSERS.
IRON STEEL, AND COPPER CORDS. LIGHTNING CONDUCTORS.
COPPER CABLES of high Conductivity for Electric Light and Power.

London: 130, STRAND, W.C. Liverpool: 7, NEW QUAY.
Glasgow: 68, ANDERSTON QUAY.
MANUFACTORY: GATESHEAD-ON-TYNE.

ROBEY & CO.

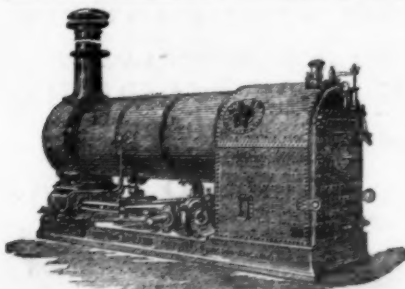
NOTICE TO COLLIERY PROPRIETORS, MINE OWNERS, &c.

The PATENT "ROBEY" MINING ENGINE is complete
in itself, ready for putting down and setting to work,
either as a Permanent or Temporary
Winding or Pumping Engine.

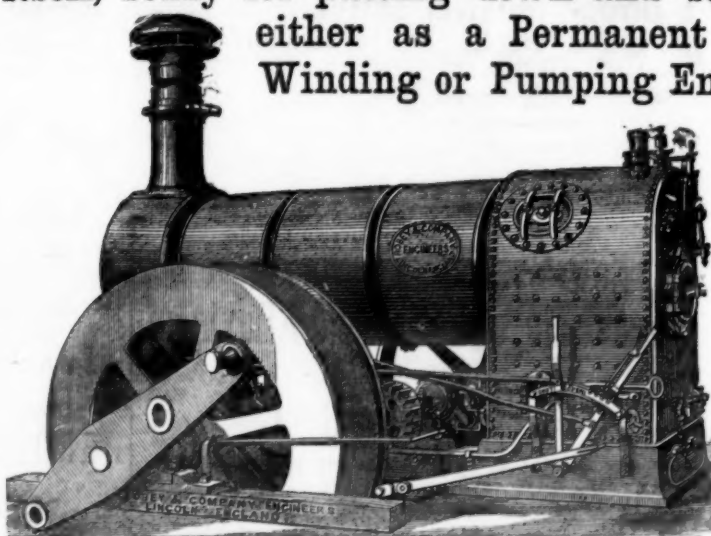


Robey's Superior Portable Engines,
2½ to 50-h.p.

LONDON OFFICES:—
117, Cannon Street, E.C.



The Improved Robey Fixed Engine and
Locomotive Boiler Combined, 4 to 65-h.p.,
and Compound Robey Semi-fixed Engine.

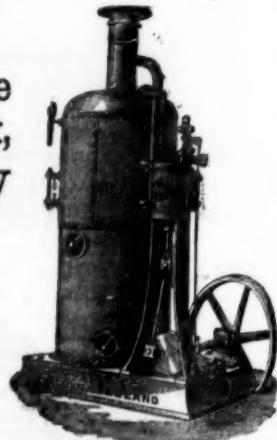


ALL SIZES KEPT IN STOCK FROM 4 TO 65-H.P. NOMINAL.

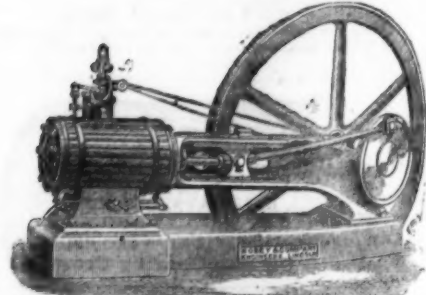
Please note this is the Original "ROBEY" Engine as designed
and manufactured by Messrs. ROBEY and Co., of Lincoln. All
others are mere attempts at imitation.

For particulars and prices apply to the Patentees and Sole Manufacturers—

ROBEY AND CO., GLOBE WORKS, LINCOLN, ENGLAND.



Robey's Vertical Stationary Steam
Engine, 1½ to 16-h.p.



Robey's Horizontal Fixed Engines,
4 to 60-h.p.

THE MINING RECORD, Only \$5.00 a year.
Foreign Postage.
61, BROADWAY, NEW YORK.
the ONLY PAPER in the United States that gives FULL LATEST ACCOUNT
from all the GREAT GOLD, SILVER, IRON, and COAL MINES of AMERICA.
ORDERS EXECUTED FOR MINING STOCKS. Information free.
ALEX. ROBT. CHISOLM, Proprietor.
London Office—H. CARTER, Manager, 36, King William-street, London.

PHILLIPS MONTHLY MACHINERY REGISTER,
THE BEST MEDIUM IN THE KINGDOM
FOR THE
PURCHASE OR SALE
OF
NEW OR SECONDHAND MACHINERY.

Subscription, 4s. per annum, post free.

PUBLISHER AND PROPRIETOR,
CHARLES D. PHILLIPS, NEWPORT, MON.

MANCHESTER WIRE WORKS.

NEAR VICTORIA STATION, MANCHESTER.

(ESTABLISHED 1790).

JOHN STANIAR AND CO.,

Manufacturers by STEAM POWER of all kinds of Wire Web, EXTRA TREBLE STRONG for
LEAD AND COPPER MINES.

Jigger Bottoms and Cylinder Covers woven ANY WIDTH, in Iron, Steel, Brass, or Copper.
EXTRA STRONG PERFORATED ZINC AND COPPER RIDDLES AND SIEVES.

PERFORATED IRON, STEEL, COPPER, AND ZINC PLATES IN VARIOUS DIMENSIONS AND THICKNESSES.
Shipping Orders Executed with the Greatest Dispatch.

R. HUDSON'S

Patent Steel Trucks, Points and Crossings, PORTABLE RAILWAY, STEEL BUCKETS, &c., &c.

Telephone No. 14.

In connection with the
Leeds Exchange, and all
the principal Hotels and
places of business in the
town.

GILDERSOME FOUNDRY, NEAR LEEDS.

(Near Gildersome Station, G.N.R. Main Line, Bradford to Wakefield and London,
via Laisterdyke and Ardsley Junctions.)

Registered
Telegraphic Address:-
"GILDERSOME,
LEEDS."
A. B. C. Code used.

UPWARDS of 25,000 of these Trucks and Wagons have been supplied to the South African Diamond Mines; American, Spanish, Indian, and Welsh Gold, Silver, Copper, and Lead Mines; Indian and Brazilian Railways, and to Railway Contractors, Chemical Works, Brick Works, and Coal and Mineral Shippers, &c., &c., and can be made to lift off the underwork, to let down into the hold of a vessel, and easily replaced. They are also largely used in the Coal and other Mines in this country, and are the **LIGHTEST, STRONGEST**, and most **CAPACIOUS** made, infinitely stronger and lighter than wooden ones, and are all fitted with R. H.'s Patent "Rim" round top of wagons, requiring no rivets, and giving immense strength and rigidity. End and body plates are also joined on R. H.'s patent method, dispensing with angle-irons or corner plates.

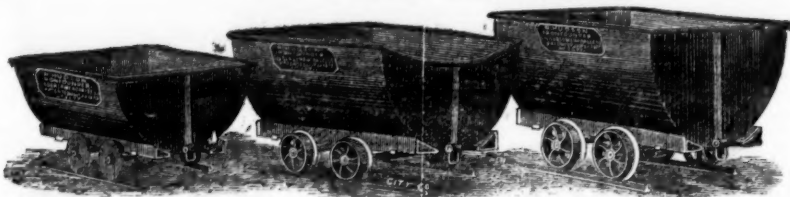
Patented in Europe, America, Australia, India, and British South Africa, 1875, 1877, 1878, 1881, and 1883.
N.B.:—The American, Australian, Indian, and Spanish Patents on Sale.

CAN BE MADE TO ANY SIZE, AND TO ANY GAUGE OF RAILS.

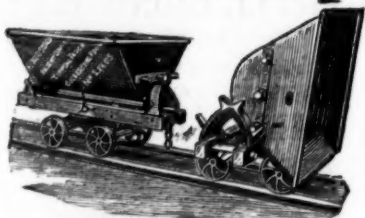
1.—PATENT STEEL END
TIP WAGON.



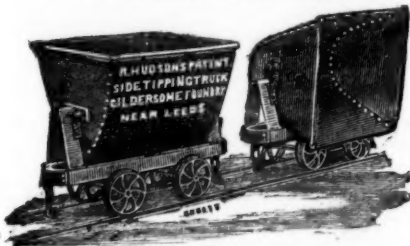
7.—PATENT STEEL MINING WAGONS.



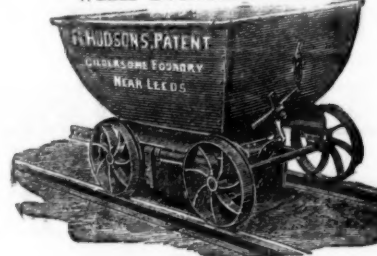
2. PATENT UNIVERSAL TRIPLE-CENTRE
STEEL TIPPING TRUCK,
Will tip either SIDE or either END of rails.



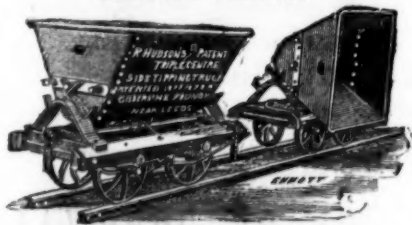
8.—PATENT DOUBLE-CENTRE STEEL
SIDE TIP WAGONS,
Will tip either side of Wagons.



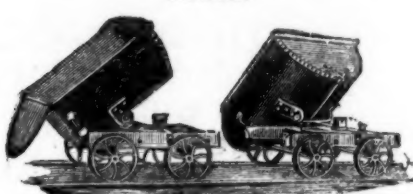
12.—PATENT STEEL HOPPER WAGON,
WITH BOTTOM DOORS.



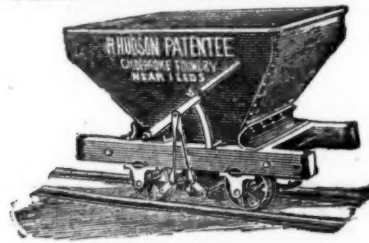
3.—PATENT TRIPLE-CENTRE STEEL
SIDE TIP WAGONS.



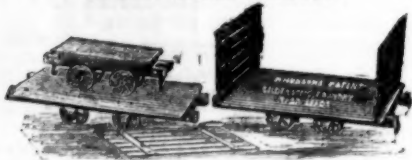
9.—PATENT STEEL ALL-ROUND TIP
WAGON.



13.—PATENT STEEL HOPPER WAGON.



4.—PATENT STEEL PLATFORM OR
SUGAR CANE WAGON.



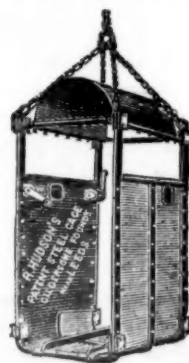
10.—LEFT-HAND STEEL POINT AND
CROSSING.



14.—SELF-RIGHTING STEEL
TIP BUCKET.
(The "CATCH" can also be made SELF-
ACTING if desired.)



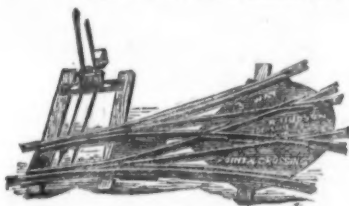
15.—STEEL CAGE.



5.—PATENT STEEL CASK.
As supplied to H.M. War Office for the late war in Egypt.
DOUBLE the STRENGTH of ordinary Casks without any
INCREASE in weight.
(Made from 10 gals. capacity upwards to any desired size.)



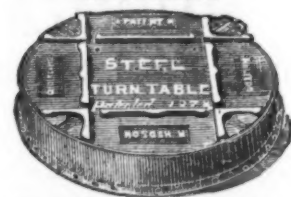
11.—RIGHT AND LEFT-HAND STEEL
POINT AND CROSSING.



16.—PATENT STEEL WHEELBARROWS.
Made to any Size.
Lightest and Strongest in the Market.



17.—STEEL SELF-CONTAINED
TURNABLE.



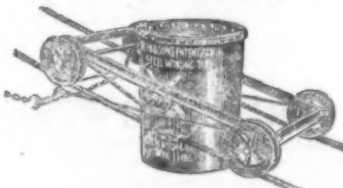
6.—ROBERT HUDSON'S
PATENT IMPROVED IRON
SMITH'S HEARTH.
NO BRICKWORK REQUIRED.

A Special quality made almost entirely
in STEEL, effecting a GREAT SAVING
IN WEIGHT.



Large numbers in use by all the principal Engineers in this
country and abroad.

18.—"AERIAL" STEEL
WINDING TUB.



Largely employed in the South African
Diamond Fields.

No. 19.—PATENT STEEL CHARGING BARROW,
DOUBLE the STRENGTH & much LIGHTER than ordinary Barrow.



ALL KINDS OF BOLTS NUTS, AND RIVETS MADE TO ORDER ON THE PREMISES

THE "HIRNANT" ROCK DRILL.

This ROCK DRILL is the result of an extensive and practical experience, and was designed to overcome the proved defects in the leading Rock Drills now in the market.

The following important points are secured in the "HIRNANT" ROCK DRILL:—

GREAT ECONOMY in motive power.

GREAT DURABILITY as the destructive shock common to the Cams of ordinary Rock Drills is ENTIRELY overcome.

THE CAM is locked at each end of the Stroke whilst the blow is delivered.

PROVISION to take up any slack in the Feed Screw arising from wear.

Four No. 3 "HIRNANT" Rock Drills have been for the past 15 months, and now are, in **DAILY USE** boring the Hirnant Tunnel, North Wales, for the Liverpool Corporation New Waterworks, together with complete plant, including

PATENT ROCK DRILL CARRIAGES,

PATENT AIR COMPRESSORS,

OUR OWN MANUFACTURE, may be seen at work at any time by appointment.

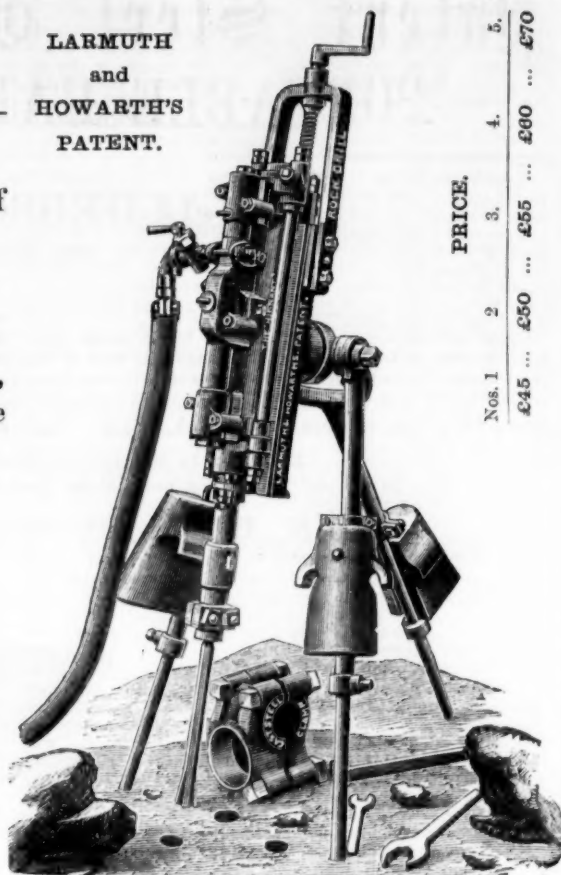
Estimates for Mining Plant, Engines, Boilers, &c., on application—

THOMAS LARMUTH & CO.,

ESTABLISHED 1837.

ENGINEERS, SALFORD, MANCHESTER.

LARMUTH
and
HOWARTH'S
PATENT.



SAMUEL OSBORN AND CO., MANUFACTURERS OF TOUGHENED CRUCIBLE STEEL CASTINGS

Of all descriptions of special strength and solidity.

ALSO, MANUFACTURERS OF

BEST CAST STEEL FOR ENGINEERS AND MINERS' PURPOSES; FILES SAWS; HAMMERS; RAILWAY SPRINGS, &c.

STEEL SHEETS AND FORGINGS.

SOLE MAKERS OF

R. MUSHET'S CELEBRATED EXTRA BEST
TITANIC CAST STEEL FOR BORERS,
And of R. Mushet's special Steel for Lathe and Planing Tools and Drills,
THE STEEL WHICH REQUIRES NO HARDENING.

CLYDE STEEL AND IRON WORKS, SHEFFIELD.

SYBRY, SEARLS, & CO.,

MANUFACTURERS OF THE

CELEBRATED MINING STEEL,  BRANDED

CRUCIBLE STEEL CASTINGS

Of Special Toughness, Strength, and Durability.

SPECIAL ROCK DRILL STEEL,

Tool Steel, Shear, Blister, Spring, Files, Hammers, Picks, &c.

CANNON STEEL WORKS, SHEFFIELD.

BRITISH AND FOREIGN SAFETY FUSE COMPANY,

WORKS: REDRUTH, CORNWALL,

MANUFACTURERS OF

PATENT SAFETY FUSE FOR ALL KINDS OF BLASTING PURPOSES,
For MINING & RAILWAY OPERATIONS,

ALSO FOR

ALL KINDS OF SUBMARINE WORK.

This FUSE is made for ALL CLIMATES, and of any length and sufficient water-resisting properties to ensure ignition at any depth.

For PRICE LISTS, SAMPLES, &c., apply at the Works, or

LONDON OFFICES—3 and 4, Adelaide Place, King William Street, London Bridge, E.C.

TRADE MARK,—TRICOLOUR COTTON (Red, White, and Blue), running through the coils of Powder.



ALEX. WILSON & CO. VAUXHALL IRONWORKS, LONDON, S.W.,

MANUFACTURERS OF

THE VAUXHALL DONKEY PUMPS.

THE EXCELSIOR DIRECT-ACTING
PUMPS.

Air Compressors.

Winding Engines.

HOISTING MACHINERY.



ILLUSTRATED AND PRICED CATALOGUES ON APPLICATION.

JUST PUBLISHED, PRICE 5s., POST FREE.

A SKETCH OF THE

GEOLOGY OF CORNWALL,

INCLUDING A BRIEF

DESCRIPTION OF THE MINING DISTRICTS, AND THE
ORES PRODUCED IN THEM.

By BRENTON SYMONS, F.C.S.,

ASSOC. MEM. INST. C.E.,

MINING ENGINEER AND METALLURGIST.

Author of "Caradon Mines," "Mining in the East,"

"Hydro-Metallurgical Processes," "Campiglia Mines," &c.

With Geological Map of Cornwall, and numerous Steel Plates,
illustrative of influence of Rock Formations on Scenery.

"From a careful study of the book a fair idea of the relative merits of the several districts for producing the different metals may be obtained, and even the reader who may consult it without any thought of turning the knowledge gained to pecuniary advantage, will find an abundance to satisfy him for its perusal—the work is at once concise, cheap, reliable, and entertaining."—Mining Journal.

"It is a sound book by a competent writer on his subject, the able treatment of which cannot but afford the man of science and those interested in mining industry, or generally in the welfare of the Western Peninsula, very valuable information. The map is an excellent one, and a copious index fitsly closes the work."—Western Times, Plymouth.

LONDON:

OFFICE OF THE "MINING JOURNAL," 26, FLEET STREET, E.C.

Second Edition. Just Published, price 8s. 6d.

A NEW GUIDE TO THE IRON TRADE,
OR MILL MANAGERS' AND STOCK-TAKERS' ASSISTANT;
Comprising a Series of New and Comprehensive Tables, practically arranged to show at one view the Weight of Iron required to produce Boiler-plates, Sheet-iron, and Flat, Square, and Round Bars, as well as Hoop or Strip Iron of any dimensions. To which is added a variety of Tables for the convenience of merchants, including a Russian Table.

By JAMES ROSE,

Batman's Hill Ironworks, Bradley, near Bolton.

OPINIONS OF THE PRESS.

"The Tables are plainly laid down, and the information desired can be instantaneously obtained."—Mining Journal.

"300 copies have been ordered in Wigan alone, and this is but a tithe of those to whom the book should commend itself."—Wigan Examiner.

"The Work is replete on the subject of underground management."—M. BAKER, Colliery Proprietor.

To be had on application at the MINING JOURNAL Office, 26, Fleet-street, London.

Just published.

THE NORTH WALES COAL FIELDS,
Being a series of Diagrams showing the Depth, Thickness, and Local Names of the Seams in the principal Collieries of the various districts, with Index, Geological Map, and horizontal sections across the Ruabon, Brynbo, Buckley, and Mostyn districts.

By JOHN BATES GREGORY and JESSE PRICE,

of Hope Station, near Mold, Flintshire.

Price: Mounted on holland, coloured and varnished, and fixed on mahogany rollers, 30s. each; or in book form, 12x9, mounted and coloured, 25s. each.

May be obtained, by order of all Booksellers, or direct from the Mining Journal Office, 26, Fleet-street, London, E.C., upon remittance of Post Office Order for the amount.

Original Correspondence.

THE SILVER-BEARING LODES OF THE BARRIER RANGES.—No. III.

SIR,—About three miles to the south-west is the Broken Hill, so called from the rugged outline of its rocky summit. This hill is the highest point in a narrow ridge which runs north-east and south-west for several miles, and forms a considerable feature in the district, rising for about 150 ft. above the general level of the undulating plain country on each side. The crest of the ridge is formed by the outcropping of a huge lode. The lode varies in width from 10 to 120 ft., and in places rises above the surface in large craggy black masses. It changes in character every few feet, and consists of ferruginous quartzite, quartz, griesen, felspar, porous brown iron ore or gossan, and oxide of manganese (pyrolusite), with patches and veins of crystallised lead (cerusite); the occasional black colour of the mass is due to the manganese oxide. Two shafts, one 52 ft. deep and the other 50 ft., and about 30 chains apart, have been sunk into the lode, as well as two smaller shafts between these. I did not see any galena in the stuff raised, but I was informed that a little had been obtained; and as the cerusite has evidently crystallised from a solution of lead derived from the decomposition of galena, I believe that masses and veins of galena will be found disseminated through the lode, as in the case of the smaller lodes near the Round Hill on the north-east and the Pinnacle on the south-west, which are probably the continuation of this one. A sample of porous gossan from near the surface gave on assay at the rate of 3 ozs. 5 dwts. of silver per ton, with a trace of lead; and two samples, one taken from a vein 18 in. thick of large crystals of cerusite, and another of a finely crystalline mass of cerusite from the north shaft on a different part of the lode, gave on assay respectively 1 oz. 12½ dwts. of silver and 73·23 per cent. of lead, and 1 oz. 12½ dwts. of silver and 74·87 per cent. of lead. These results cannot be taken as indicative of the argentiferous nature of the lode, for the galena from which the cerusite has been derived may have been rich in silver, and yet the silver may not have entered into the solution from which the crystals of cerusite were formed. Therefore, the richer silver ore will probably be found in association with the undecomposed sulphide of lead, silver, &c., or in the oxidised portions of the lode which originally contained the sulphides. Mr. George McCulloch, of Mount Gipps, showed me the results of assays of 26 various samples of the ore taken from different parts of the lode, which gave at the rate of from 4 ozs. to 45 ozs. of silver to the ton, and 10 to 70 per cent. of lead, or an average of 14 ozs. 17 dwts. of silver to the ton, and 46 per cent. of lead. Further prospecting will, I am of opinion, prove this to be a valuable argentiferous lead lode. It appears to dip with the strata about north 40° west at 50°, and on the north-west side sends off several branches; about 10 chains from it there is a large dyke of diorite. It is remarkable that no gold has yet been found in the vicinity of these intrusions of diorite.

The Pinnacles lodes are situated about 15 miles south-east from Silverton. There are two main lodes—one of them, the Minnie Moore, has a general strike to the north-west for about 10 chains. In one shaft, 7 ft. deep, the lode is seen to be from 3 ft. 6 in. to 4 ft. wide, dipping west 30° south at 70°, in talcose mica schist, and consisting of ferruginous crystalline quartzite, with galena interspersed here and there through it, and patches of yellow gossan. An average sample taken from the whole width of the lode gave on assay at the rate of 78 ozs. 8 dwts. of silver per ton and 32·40 per cent. of lead, and of the yellow gossan 22 ozs. 1 dwt. of silver per ton and 3 per cent. of lead, with traces (under 2 dwts.) of gold. The hanging-wall is ferruginous chlorite rock. The lode winds about, and in one place suddenly widens to 30 ft.; in two places it divides for a few yards and unites again, in others it sends off branches which thin out entirely. Within 4 chains of it on the north-east side two other smaller lodes crop out. About 5 chains to the south-west is a mass of ironstone 12 ft. wide in the middle, then thinning out within a length of 50 ft. This forms the end of the Charlotte Greenway lode, which runs to the south-west for about 10 chains, with a winding course like the lode just mentioned, and varying in width from 2 to 36 ft. It also consists of ferruginous quartzite, containing patches of galena. From the south-east side there is a branch lode 25 ft. long and 4 ft. wide, with galena; and 50 ft. off, on the north-west side, is a separate and nearly parallel lode about 6 chains long, and varying in thickness up to 20 ft., with galena irregularly distributed through it. A sample of the ore which I took from near the surface, and consisting chiefly of galena, yielded on assay at the rate of 53 ozs. 1½ dwts. of silver per ton, and 41·12 per cent. of lead, with traces of gold. Messrs. Moore and Russell informed me that 12 assays which had been made for them of samples from these lodes gave at the rate of from 16 ozs. 6 dwts. 16 grs. to 583 ozs. 2 dwts., averaging 137 ozs. of silver per ton, and another assay gave 1504 ozs. 6 dwts. of silver per ton. It will be seen that these lodes are of large size, and I consider that they will be permanent. They have only been prospected to a depth of about 7 ft. I did not notice any chloride of silver, but it is probably present in the oxidised portions of the lodes. The chief silver-bearing ore is the galena, which occurs in patches and grains here and there, and much of it can only be separated from the hard lode stuff by crushing and concentration. With careful working I think that considerable quantities of payable ore could be raised.

About 1 mile north-east from these lodes is the middle hill of the three Pinnacles, which are remarkable conical hills rising about 250 ft. above the level of the adjacent country. It consists of a mass of laminated ferruginous hard quartzite of a metalliferous appearance, but I do not see any other than iron in it. At the base of the hill are soft calcareous talcose mica schists, which strike about north 35° west, and are traversed by dykes of garnetiferous pegmatite granite and diorite, quartz reefs, and small lodes of quartzite resembling the rocks in the Pinnacles lodes. Most of this country has been pegged out, and is being prospected.

From here to Silverton, and thence to Thackaringa, the same schistose rocks, with garnetiferous granite, diorite, and quartz reefs continue, forming gently undulating country, and in places rough, rocky hills, some of which are from 200 to 250 ft. high.

At Thackaringa, within a radius of 4 miles, upwards of 30 silver-bearing lodes have been discovered; of these I have examined 22. As they are nearly all of the same nature—lenticular lodes of gossan, with carbonate of lead and galena, I need only describe a few showing the characteristic features.

On the Gipsy Girl Company's property the No. 1 lode, which has been opened to a depth of 20 ft., following the underlay from the surface, and also in a shaft 40 ft. deep, varies from 6 in. to 3 ft. thick, and consists of carbonate of lead and galena, accompanied by quartz and ironstone stained with carbonate of copper. It dips north 20° west at 30° traversing mica schist, and is in one place divided by a horse of granite. It appears on the surface for about 7 chains, then a small ferruginous quartz and galena vein comes in, dipping east 10° south at 35°. The manager, Mr. J. H. Ellis, informed me that the ore yields about 50 ozs. of silver per ton, and 72 cent. of lead.

No. 2 lode consists of from 4 to 14 in. of galena, with 2 ft. of iron ore and quartz beneath it. It dips north to north 20° east at 13° in altered sandstone and schist, intersected by numerous quartz veins, and containing carbonate of copper. An assay of a sample of the ore underlying the galena gave at the rate of 4 ozs. 18 dwts. of silver per ton, 14·87 per cent. of copper, and a trace of gold. The shaft is 12 ft. deep. Six chains to the west the same lode dips north 20° east at 47°, showing galena in quartz. In places the galena is very finely crystallised, and in others it occurs in large cubical crystals up to 1 in. or more in diameter. I collected samples of the varieties of galena for assay, but they have not yet arrived from Adelaide.

The lode in the adjoining Goat Hill Mine (Messrs. Ellis and Owen's) is of variable thickness up to 5 ft., and consists of gossan and galena and carbonate of lead irregularly veined through it; it also contains carbonate of copper and iron pyrites. The water level has been struck at a depth of 72 ft. on the underlay, which is east 20° north at 60°. Five chains southerly is another shaft 38 ft. deep; the lode is of the same character, and from 1 ft. to 2 ft. 6 in. wide, in mica

schist, but with a granite dyke on the upper or hanging-wall side. About 6 chains to the east is another similar lenticular gossan and galena lode, from 6 to 18 in. thick, dipping east 10° south at 70° in mica schist.

At the Hercules Mine (Campbell's) the lode is from 12 to 18 in. thick, consisting of ironstone, carbonate of lead, and galena. It has well-defined walls, dipping easterly about 55°, and the rock in which it occurs differs from the general country rock of this district, being a hard horn blende mica schist, containing veins of calcite and quartz, with garnets. A shaft has been sunk upon it 80 ft. deep. The ore is said to yield from 40 ozs. to 80 ozs. of silver to the ton, and from 50 to 70 per cent. of lead. Another lode, which is being prospected on the same property, is 10 in. thick, with lenticular patches of galena 3 in. thick. It dips east 15° north at 30°, in mica schist, and hard altered sandstone. A short distance to the south-west, in portion 11, a lode 4 ft. thick, of ironstone and quartz, containing galena 1 ft. thick, has been opened to a depth of 6 ft. in mica schist. It is seen again about 100 yards to the north-west. The same lode also shows 2 ft. thick, maintaining the same dip, east 30°, north at 20°, near the north-east corner of portion 10; and 5 chains further north 10° east is another outcrop, 3 ft. 6 in. thick, of galena, quartz, and ironstone, stained with green carbonate of copper; it dips east at an angle of about 30°. North of this is the Nevada lode, which dips east at 45° in one place, where it is 1 ft. 10 in. thick, and then its outcrop turns round to the north-west. It also consists of galena, quartz, and gossan, with carbonate of copper.

In the Pioneer Company's ground a lode 2 ft. thick, with bunches of galena, carbonate of lead, and ironstone stained with green carbonate of copper, has been opened, for a length of 20 yards and 6 ft. deep, and from it the manager, Mr. T. Rosewall, informed me that he had taken about 100 tons of ore. It dips east 20° south, at 17°. Seven other lodes, from 3 in. dip to 6 ft. wide, have been worked in the same property. In one of them a vein of galena, from 2 to 9 in. thick, is continuous as far as it has been sunk upon, for 8 ft. Otherwise the galena occurs generally in lenticular masses, as may be well seen in another lode which has been opened to a depth of about 8 ft. in the north-east corner of portion 6. Within a distance of 10 ft. the lode varies from 12 in. to 6 ft. thick. It dips east 35° north, at 33°, in mica schist, and consists chiefly of compact and porous brown iron ore, with cavities lined with crystals of specular iron, quartz in veins and patches, and lenticular masses of galena; it also contains a little carbonate of copper. I have made a sketch of this lode, as it illustrates the general character of most of the lodes in the district—not only the variable thickness of the lodes, but also the patchy manner in which the argentiferous lead ore and quartz occur in them. The outcrop of this lode can be seen for about 4 chains. The greatest depth to which the lodes have been worked is only 30 ft. About 700 tons of ore are reported to have been raised during the past 12 months from the Pioneer lodes.

The Exhibition lode, in portion 32, is 1 ft. 10 in. thick, with small bunches of carbonate of lead, galena, and quartz in mica schist, stained with green carbonate of copper. It dips north-west at 40°, and has only been sunk into 4 ft.

The Bonanza lode, in portion 35, varies from 1 ft. 8 in. to 3 ft. in thickness, and is composed of spongy gossan, with carbonate of lead and galena, the latter in solid pieces, 6 in. thick. It dips north-east at 20°. Three small shafts have been sunk, and from them the lode has been worked on its underlay; about 120 tons of ore have been raised. The country is mica schist, with dykes of granite and diorite.

Near this is the Comstock lode, which dips south-east at 50°, with quartz on the hanging-wall, and galena up to 3 ft. in bunches in gossan. It traverses mica schist, the vertical cleavages of which strikes east 10° north. Two shafts, each about 25 ft. deep, have been sunk 25 ft. apart; 56 tons of ore are said to have been sent away.

I understand that galena was discovered at Thackaringa about eight years ago, but it is only within the last two years, and chiefly during the last year, that much attention has been given to the lodes. The search for other lodes, consequent upon the development of these, led to the discovery of the silver lodes in the Silverton district. I am indebted to Mr. J. H. Ellis for particulars as to the approximate quantity of ore that has been raised from the various mines at Thackaringa, and which amounts to about 2036 tons. I believe that the lodes already discovered here are at once capable of an annual output of at least 20,000 tons of argentiferous galena. At present there are only about 50 miners at work in this part of the district.

About 60 miles north of Silverton, and 9 miles from Corona Station, several iron and manganese lodes have been lately discovered. From one of them I collected an average sample of ore, which yielded at the rate of only 1 oz. 12½ dwts. of silver per ton. The country here consists of clay-slates and altered sandstones, dipping east 10° north at 45°, and traversed in a meridional direction by large and small lenticular quartz veins, containing brown iron ore and manganese oxide. About 3 miles further north there is a large mass of quartzite cropping out high above the surface for 100 ft. in width and 3 chains in length; on the east side of it there is a belt of yellow limestone, which in places passes into a network of quartz veins. I did not see here any mica schists or dykes of granite, which, as before stated, are always present in the vicinity of the silver and lead lodes in the Silverton district; but within a few miles to the east the granite and altered mica schists appear, and it is probable that in this vicinity silver-bearing and other metalliferous lodes, inclusive of gold, will be found. A sample of an ironstone vein, cropping out alongside the road 5 miles south from Corona, yielded an assay at the rate of 3 ozs. 5 dwts. of silver per ton, and a trace of gold. Half a mile to the east of the Mount Brown Road, and 9 miles north of Corona, a copper lode has been prospected to a depth of about 40 ft. It is from 1 to 2 ft. wide, vertical, in mica schist, and strikes north 35° east. It contains green carbonate and red oxide of copper, and in sufficient quantity to be workable for copper; one average sample of the ore gave an assay at the rate of 4 ozs. 12½ dwts. of silver and 3 dwts. of gold per ton, and 24·55 per cent. of copper. Between this and the Corona station several large ironstone and manganese lodes crop out, some of which may be the caps of copper lodes. About 1½ mile west from Corona there is an immense outcrop of brown iron ore 4 chains long and about 2 chains across in the widest part; it rises about 30 ft. above the surface. An assay of this ore gave at the rate of 1 oz. 12½ dwts. of silver per ton, and a trace of gold. On the east side of it is a belt about 20 chains wide, of yellow limestone, and in places along the margin of this, in a southerly direction, smaller lodes of ironstone crop up.

Between Corona and the head station of Poolamacca, Mr. K. Brodribb's, there are numerous quartz reefs, some of them containing brown iron ore, and near the station are two short reefs of quartz showing gossan, galena, and copper ore; but an assay of this gave only at the rate of 8 ozs. 3 dwts. of silver to the ton and a trace of gold. The country here consists of mica schists, clay slates, flagstones, limestones, and conglomerates, traversed by quartz reefs and dykes of diorite and granite containing garnets, black tourmaline, and chlorite. With the exception of the limestones, the formations are similar to those of the silver-bearing country near Silverton. About 14 miles south-south-east from Poolamacca, on the road to Mount Gipps, a massive dyke of ferruginous quartzite crops out above the surface, striking south 10° east at intervals for several miles. This should be examined for gossan deposits.

Sixteen miles north-east from Poolamacca, and near the Euriowie Gap, the schist rocks are traversed by large masses of dykes of pegmatite granite. In one of these dykes, from 1 to 5 ft. wide, Messrs. R. Hodgson and J. March have found tin ore. The ore occurs in detached crystals through the granite, which consists for the most part of white pearly mica, with quartz and a little orthoclase felspar. The prospecting shaft is 7 ft. deep. The lode or dyke dips east 35° north at 75°, and can be traced for about 10 chains, but only showing tin ore in a few places. About 60 chains north 10° east from here a similar micaceous tin-bearing lode has been opened by Messrs. T. Murray and W. Brooks. It strikes about north 30° west, with a winding course for 15 chains, and varies in thickness from 1 to 6 ft. The tin ore appears to be only in patches in it. Within 6 chains west are two smaller lodes of the same character. One of them has been sunk upon to a depth of 10 ft. It dips east 35° north at 85°, and is 3 ft. 3 in. thick; the tin ore in black crystals occurs chiefly

near the hanging-wall. In the schist 18 in. from the footwall there is a vein 4 in. thick of ferruginous graphite.

This locality deserves further prospecting, for I have no doubt that other deposits occur in some of the numerous granite dykes. At present I do not think that sufficient ore could be raised to warrant the erection of a crushing plant. The country is favourable also for the occurrence of silver and other metalliferous lodes. IOTA.

Sydney, Oct. 1.

QUEENSLAND COPPER—NEW DISCOVERY.

SIR,—Whilst South Australia has had its Burra Burra and New South Wales has its Great Cobarr, Mount Hope, and Burrage Copper Mines, Queensland has as yet not had any exceptionally valuable one, as the old Peak Downs, though profitable for a time, was never to be compared in its best days with the premier mines of the other two colonies; but I think its day also is at hand now, for from the statement I heard and the samples I saw last week in Sydney (knowing well the honourable character and undoubted knowledge and ability of my informant, who is the discoverer) the new find in North-Western Queensland bids fair to fully rival anything yet found elsewhere in Australia.

It is situated in the mountainous country near the South Australian border, and about 80 miles from Cloncurry, with the new railway line to the Gulf of Carpentaria, when finished intersecting the property (a freehold of 750 acres), on which the various lodes are. They are said to consist in all of 22—each of them stronger and larger than the Cloncurry's best lode—and so far as yet proved of a much richer ore than that, averaging probably 15 to 20 per cent. higher—in fact, the one lode that has been most opened up shows already better both as to quantity and quality than all the known ones in the whole of the Cloncurry's 2500 acres. This remark is not made in any disparaging tone as to the value of the latter, but simply as a mere matter-of-fact, it having been proved for over 2000 ft. of its outcrop, whilst its width for at least 900 ft. is 15 ft., consisting of 7 ft. of solid red oxide, averaging 47 per cent., and 8 ft. of carbonates and oxides of about 20 per cent., every fathom of the oxide being estimated to turn out 15 tons of refined copper. The samples I saw in Sydney were four blocks, of from 4 to 7 cwts. each—great solid lumps of dense heavy ore, with only a few small pieces or quartz showing in one of them—in fact, I never saw such specimens in one lot here yet; and I doubt very much if even our own Great Cobarr, with its 30 ft. lode, could produce such sized masses of clean ore or one-half as rich.

I am very sceptical in mining matters, and would neither have credited half of this statement nor written about it, were it not that it is personally furnished to me by Dr. Robertson, F.R.G.S., who has been all over the property, and seen the workings and the samples sent down to Sydney; but with all my well-founded doubt of reports I have faith in his judgment and honesty from my long experience of him whilst out here, and have no hesitation in saying that however over good it may look he is much more likely to be right than mistaken, and for the welfare of Queensland I also hope it is so.

The new railway when completed will of course facilitate both its working and the cheap and easy shipment of its copper; and Dr. Robertson informs me the climate is such that whilst during the three hottest months the heat nearly reaches beyond 100° it is always cool at night, and for seven or eight months in the year it even freezes, so that unlike some of the other mining districts white labour is as available as coloured.

For gold, Gympie still keeps up its character for rich returns, as the total amount of the dividends declared during the month of September is 31,672£, of which No. 1 South Wilmot Company has paid 21,000£, having crushed 298 tons of stone for a yield of 6283 ozs. of gold. The other principal dividends were—Ellen Harkins, 5000£; the Wilmot, 1000£; and No. 1 North Phoenix, 2500£.

Sydney, Oct.

R. D. A.

THE TIN DEPOSITS OF NORTH QUEENSLAND.

SIR,—For the welfare of British colonies, and especially the younger of them, it is essential that their natural resources should be brought to the notice of the capitalists of the mother country, and more especially so when, as in the case of the tin deposits of North Queensland, the judicious application of British capital would benefit the colony and at the same time yield handsome profits to those supplying it. There appeared in the Sydney Mail of Aug. 30 the subjoined paragraph, which is commended to the attentive perusal of the Wild River district miners, and to the shipping agents at Port Douglas and Cairns, and it will not be less interesting to miners at home:—

"The quantity of tin imported into the United Kingdom during the year 1883 from Australasia, as we learn from a return published by order of the House of Commons, was—South Australia, 1 ton of tin ore; Victoria, 3 tons of tin ore and 510 tons of blocks, bars, ingots, and regulus; New South Wales, 10,339 tons of blocks, bars, ingots, and regulus; Queensland, 22 tons of tin ore; Tasmania, 114 tons of blocks, bars, ingots, and regulus. The Straits Settlements is the only locality that can compare with New South Wales in regard to the quantity of tin sent to England, their record being 14,012 tons of blocks, bars, ingots, and regulus. The total quantity of tin imported into Great Britain during the year 1883 was 1156 tons of tin ore and 26,052 tons of blocks, bars, ingots, and regulus."

That such a return should be published and laid unexplained before the House of Commons is, in the opinion of the *Herberton Advertiser*—the leading representative of mining and material interests in North Queensland—entirely owing to the system of ignoring North Queensland products by the Metropolitan Press. It is now some 14 months back that, foreseeing a prejudicial result, we suggested that the Brisbane papers take reasonable notice of the mineral products of Northern Queensland, and that by publishing the quantities of tin that passed in transit to Sydney it would become known at home that nearly all the tin that was exported from New South Wales was the produce of Queensland, and that it was forwarded to the sister colony chiefly for smelting purposes, and thence shipped home. By the above return Queensland is credited with having exported to the United Kingdom in 1883, 22 tons of tin ore. So little to the contrary appears to be known in England as regards tin being produced in Queensland that the comments to said return states, "that the Straits Settlement is the only locality that can compare with New South Wales in regard to the quantity of tin sent to England." What are the real facts? We have no record of the quantities of tin despatched south from Cooktown or Stanthorpe in 1883; but in that year the quantity exported from this district alone amounted to 2821 tons 12 cwts., valued at 151,903£, and there being then no smelting institution in Queensland the whole of it was shipped to Sydney, and was included in that colony's exports and received in England as that colony's product. No mention has ever been made in the *London Mining Journal* or other commercial journals of the quantity of tin produced in Queensland, simply because the metropolitan papers seldom allude to it, and despite our colonial lecturers, who have been largely paid to make known the tin capacity of the colony amongst its other resources, the House of Commons, the first British tribunal, is informed that Queensland was able to produce in 1883 22 tons of tin ore. Why was not such a flagrantly false and damaging statement repudiated by the Agent-General, or how is it that the metropolitan papers care so little for the general interests of the colony as to have permitted so libellous a document as that laid before the House of Commons without venturing a line to refute its accuracy? We make mention of the metropolitan papers because the principal ones issue monthly summaries for Europe, and they are supposed to possess resources by which they can acquire a full knowledge of the large exportation of tin that is weekly, monthly, and annually taking place from this and other stanniferous centres in North Queensland. As a matter of fact, the quantity of tin and tin ore exported from this district to Sydney in 1883 forms nearly a fifth of the whole of the quantity exported to England from New South Wales during the same year, which is set down at 10,339 tons in various forms, and yet through negligence at the principal port (Brisbane) Queensland is credited with exporting 22 tons of tin ore only.

At the present time the Herberton district is the largest tin pro-

ducing locality in Queensland, and the circumstance at least deserves recognition. With such a return as that laid before the House of Commons it may occur to some members that the Government of Queensland must have extraordinary views by constructing an expensive railway to a locality capable of exporting only 22 tons of tin ore in a year. The right of New South Wales to place the tin from here amongst her exports is by no means contended, inasmuch as probably the whole of it was the property of her merchants by purchase or otherwise, but what is strongly protested against is the system pursued in Brisbane, by which no record is kept of the quantity of tin from North Queensland in vessels entering that port in transit to Sydney, information that should be considered valuable as a means of showing that the colony can produce more than 22 tons of tin ore annually.

Finally, as a manifestation of the utter valuelessness of the return above referred to, and to the want of interest displayed at Brisbane in the important tin industry of Northern Queensland, it may be mentioned that the Treasurer, in his tables relating to his recent financial statement, shows the value of the tin exported from Queensland in 1883 to be 298,845*l.*, thus confirming the statement that 22 tons of tin ore being the extent of the year's export was a deceptive *fiasco*, and that the Herberton district produces nearly five-sixths of the whole of Queensland's tin.

Now it almost appears that some influences are also at work in England to keep the resources of North Queensland as a tin producing region in the background, but I can assure the readers of the Journal that the district will assert itself, and perhaps more quickly than many expect; so that the real question is, whether British capitalists are disposed to secure the profits which are readily realisable, or whether they will leave others to do so. At present there are many properties which could be acquired at prices that would permit of 50 per cent. or more being realised upon the amount required for the purchase of machinery and the payment of wages during development; but if capitalists wait until everything is in second-hands the results will of course be less satisfactory.

Herberton, N.Q., Sept. 25.

M. A. O.

PROSPECTORS AND SCIENTIFIC GEOLOGISTS.

SIR,—I wish to make a few suggestions on the subject of prospecting for minerals and metals in Queensland, which I think by aiding our mining pioneers will have the effect of opening up country containing minerals and metals other than gold, some of which I believe will prove more remunerative than the average gold mines. Most of our prospectors pay their attention chiefly to gold or other metals that are to be found with the aid of a tin dish, who, if they get satisfactory indications, will then thoroughly explore the ridges, and if not they invariably pass on without examining them. Now, some of the most profitable minerals and metals are not to be found in this way, and can only be found by a knowledge of the various mineral-bearing rocks and the appearance of surface ores. Those found below the action of the atmosphere are not of much assistance to the prospector, as they are often very dissimilar. This knowledge is not easily obtained by the majority of prospectors. The method of disseminating this knowledge could be easily accomplished in the following manner:—We have two good Government geologists, and several geological maps and reports have been made by them; but how few of them have got into the hands of the men most likely to turn them to good account? If science and practice in mining join hands, a general improvement must take place, and what I suggest in this instance is that the geologist in making his maps and reports should always keep in sight the fact that they are intended to assist the prospector in developing new mining industries. A geologist should be able to state that from the similarity of the rocks in any locality to some known field, this, that, or the other mineral or metal may possibly be found. If this was done many of our prospectors would be only too anxious to give any place so pointed out a fair trial. Many other hints could also be given that would assist the prospector. Another thing I consider necessary would be to have a case of specimen rocks properly classified, so that an ordinarily intelligent man could see at a glance specimens of the different rocks that each mineral and metal occur in. Besides these rocks specimens of all the various surface ores, together with the geological maps and reports, should be open to public inspection at every mining registrar's office throughout the colony, the maps and reports to be on sale at a cost sufficient to cover printing expenses. I hope to see this subject fully discussed in the mining papers, and when the test plan for aiding our prospectors in discovering our unfound mineral wealth has been arrived at, then have it advocated in the proper quarter. I saw in a late Queensland paper an inexhaustible mineral oil spring or well has been found at or near Tamut, N.S.W., a part of the country that has been thoroughly prospected for gold; but owing to the want of the necessary knowledge it has been passed over by hundreds of men with a tin dish.

L. R. ASHTON.

In *Charters Towers, N.Q., Mining Journal.*

MINING IN SPAIN—ASTURIAS.

SIR,—The mining interests of Spain, in so far as concerns exports of ore on foreign bottoms, are at present very seriously affected by the quarantine imposed upon all ships arriving on the coast to load; those from England suffering five days' quarantine in Santander, for any port they may be bound east of, and including, Gijon. The lack of orders in the ironworks of this district causes a general slackness, that is and has been felt for some time. Some of the works have blown out one or more blast-furnaces, and a number of hands are thus thrown out of employ. Others continue working for stock, hoping that there will be an improvement at the beginning of the year. The coal market suffers in proportion with the general state of the iron and metal market; and most of the collieries that depend upon the consumption of the local ironworks are working half-time, whilst others have stopped altogether. Contracts have, however, been just signed for the supply of the requirements of the navy and arsenals for three years. Delivery will commence immediately. This will, to a certain extent, relieve the market, and the hopes entertained of an improvement are well founded.

We must not, therefore, take a pessimistic view of the position; and, in order that capitalists in England may be prepared for business that may be offered when the improvement takes place, we think it well to note a few salient matters that are well worthy of their best attention, and which will well repay them for an outlay of capital.

The Asturian coal field contains a large number of seams of most excellent steam, locomotive, gas, smith's, and coking coals. The north-western portion of the field is well served by the Langres Railway, which traverses it from one end to the other. But the eastern part has no communication with a shipping port, although coal is very abundant, and of excellent quality. A railway constructed from there, with outlet at Rivasella or Gijon, would yield abundant results if combined with the opening up of the coal seams that abound. The distance to either port would be about 30 miles, and the line could be constructed economically. In order to prove the seams are abundant and close lying it is sufficient to say that in La Moral Colliery, leased by the Britannia Mining Company, there are in a horizontal width of 2000 metres 56 parallel workable seams of coal, of which to the present only some 10 seams have been touched, and those only above adit. But the riches of the province are not confined to the coal measures. Very extensive deposits of brown and red hematite iron ores exist at Carrabia, a district within easy reach of the sea, and shipping ports. These deposits are now being partially opened up by the people who have secured sets upon them. They consist of immense masses, as well as regular lodes.

A general sample of the produce was taken by a chemist and known sampler, and assayed by Taechmacher, yielding as follows:—Metallic iron 63 per cent., silica 3 per cent., without a trace of sulphur, and only .005 phosphoric acid. This ore would yield a magnificent No. 1 pig-iron, adapted for Bessemer steel or for general castings. The deposits are situated within 2 miles of Isla—a small bay close to the little port of Lastres, where ships loading at Isla enter and clear at customs—and within 12 miles of Rivasella, a good cart-road. Isla is a small natural harbour, having a depth of about 8 ft. at low water. Ships lie off, and are loaded by lighters in ordi-

nary states of the weather. A relatively small outlay would make this a good and safe harbour.

At present a good cart-road is being laid to this shipping place; but if a tramway was laid to it carriage of the ore would be effected at a merely nominal rate. About 500 tons per day can be cut in the present state of the workings, but when these are laid out in due order this quantity could be quadrupled. Some ore from this place has been taken out and delivered to the Gijon district ironworks, and has been found to give excellent results. Bilbao will ere long have a large portion of its deposits worked out, and the attention of iron manufacturers will ultimately have to be turned to supplies from other places. This Carrabia district is well worthy of their attention. At the foot of these deposits there are others of manganese-ferous iron ore, which have a percentage of 40 per cent. peroxide of manganese, and 18 to 20 per cent. of iron. These up to the present have not been touched.

Then, again, at a little distance from this extensive deposits of manganese, yielding 60 to 68 per cent. peroxide of manganese, free from lime or other deleterious matters, exist. These occur in nodules in a deposit of indurated clay, and are separated by being broken up with mallets, and washed. For this purpose there is an abundant supply of water. But at the present this is badly classified, since the percentage of manganese might be elevated beyond the present units. The present output is shipped at Lastres or Rivasella, and is sent exclusively to France or Belgium. The deposit is extensive, and well worthy of attention. There are a number of other places in the province which might be leisurely examined with a view to their development, and which would repay outlay. We will treat of some of these in a future letter.—*Gijon, Nov. 19.* J. A. JONES.

MONTANA COMPANY.

SIR,—Our directors appear to have allowed our affairs to drift into a hopeless mess and muddle; and, what with our extravagant expenditure, inefficient local management, and the contraction of a heavy mortgage debt on the property with the vendor, our chance of emerging from our difficulties appears small indeed. In such a plight everybody is in fault except the individuals who direct its affairs. To save their reputation a false issue is raised. As our Chairman asserted at the meeting that our prospectus was founded on Mr. Darlington's report I have compared the one with the other. I find in the prospectus the assumed value of the quartz set down at 750,000*l.*, the annual profit estimated at 140,000*l.*, the whole body of the lode to be worth \$40 per ton, and the whole length of the Cruse level in good paying ore, &c.

Now, to my great surprise, I do not find a word, line, or paragraph in Mr. Darlington's report on these several points; indeed, his report is singularly free from the language of exaggeration, and goes no further than to offer an opinion that our property is one likely to be profitable. It is, in fact, the report of one evidently experienced in the chances and vicissitudes of mining, promising nothing in the way of money results. As I now read the prospectus it seems to me that the extract from Mr. Pixley's letter, together with the estimate given of the quartz 750,000*l.*, as well as the estimated yield of \$40 per ton from the whole body of it constituted the statement on which the property was purchased, and to which is traceable the mischief and the disappointment prevailing at this time.

Croydon, Nov. 25.

F. J. K.

GOLD MINING IN MERIONETHSHIRE.

SIR,—I find that there have been some remarks made upon the above subject in the *Mining Journal*, which, I consider, are likely to mislead the general public. Permit me, therefore, to submit a few facts, which will, I believe, throw some light on the subject, and show the cause why all the gold mines of the neighbourhood have been relinquished. Firstly, there has been great mismanagement. Secondly, there has been the want of the proper appliances to extract the precious metal from the quartz, and other metals it contains. Gold is generally found in quartz veins of an average width of 6 ft., running east to west, with greenstone at one side, and clay-slate at the other. It is mixed with lead, blende, copper, bismuth, antimony, silver, arsenic, &c. Without experienced and practical men it is both difficult and troublesome to extract the gold from the quartz and these metals.

I may say, further, that every miner knows, so far as his own country is concerned, the best method for extracting the precious metal from the quartz. There is great difference in the quartz veins of North Wales, and that of any other country; and of all other stuff in mining it is most difficult with which to deal. It, therefore, requires to be dealt with in the most simple manner by experienced and practical men living in the neighbourhood of such mines. Every intending investor must know that with judicious management the outlay must produce good results. I remember a few years ago a mining agent paying 73*l.* 5*s.* per fathom for driving a level 5 ft. by 7 ft., and in the same ground at the opposite side it cost only 6*l.* per fathom; thus showing the difference between experience and no experience. I could mention many other instances to show the failure of mismanagement, such as putting up different machinery simply to try experiments which turned out worthless. It is certain that 2 cwt. of quartz produce 63 ozs. of gold, and as much as 6243 oz. was extracted in 18 months, at a cost of 3000*l.*, out of one mine in the district; and the above facts will prove beyond doubt the necessity of engaging good and practical men to make our mines prosperous.—*Ganllwyd, Nov. 26.* E. J. T.

A NEGLECTED MINING DISTRICT.

SIR,—I may perhaps not be considered intrusive if I solicit space for a few remarks on the depressed state of mining in the Isles of Man. It is much to be regretted on many accounts that an industry which properly conducted pays so well should be in such a condition as that now existing in the south of the island. Capitalists go from one extreme to another. Three years ago they were too eager to invest in mines, catching at anything presented to them that had a high colouring without taking pains to investigate its merits, and so being disappointed they have gone to the other extreme, and cannot be persuaded to invest in anything, however promising a mine may be, however certain of early returns, people look on with indifference.

If there be any sound speculators I would call their attention to the discovery made in the Raneen Mines, Isle of Man, and supply satisfactory evidence of its sterling worth. Having heard of the grand discovery made in the above mine, I took a ramble over it at surface, and from what I saw I was compelled to say, like the Queen of Sheba, "the half was not told." Some 30 or 40 tons of solid lead is at the shaft top, and from the size of the solid lumps the lode must be worth fully 6 tons per fathom, and from the information I gathered this is coming from near the bottom of the mine. I may add that I have no interest whatever in the above concern; but wish to show the public that good investments can be found at their own doors.

Port Erin, Nov. 24.

MINER.

ECONOMIC TREATMENT OF RHEA GRASS, AND OTHER INDIAN FIBRES.

SIR,—As the *Mining Journal* has extensive circulation in India, the following observations on China grass obtained from the stalk of the Bashmeria (Urtica) nivea, a plant belonging to the Urticaceae or nettle order, will be useful and interesting to your readers.

The decay of coffee plantations in India, and fall in value of agricultural productions, has drawn the attention of cultivators to fibre plants, and the natives of India are well acquainted with all of these, and numerous attempts have been made with China grass, for the reason that it produces four crops per year, and that the most beautiful cloths can be manufactured from it, but the price demanded by the Chinese does not permit its extensive use in England. It realises in limited quantities 80*l.* per ton, but when the price lowers to 35*l.* per ton then the Chinese entirely cease to export it. It is coveted by manufacturers to form the network of fine and rough woollen cloth, being the strongest and longest fibre known, and of unsurpassed fineness and gloss; but they cannot afford to pay above 25*l.* per ton for it, and, therefore, this beautiful product is prohibited to us from its high price. The Government of India has offered a high reward for the best machine to prepare, and avoid the excessive expense hitherto required, but none have yet been successful. The Chinese

method is entirely by hand labour, and the gross weight of the stalk only produces 5 per cent. of fibre, and the profit resulting to them is necessarily small, as they first cut open each stalk with a knife from end to end, and take out the pith. They are then made up into bundles, and put into clean water for a few hours to deprive the bark of its tannin matter. They are then hung on a post, and the operator with the thumb of his right hand passes it quickly from end to end, and strips off the outer bark, afterwards scraping each stalk two or three times with a knife.

Thus it is impossible, with so much handling, to produce it at a cheaper rate, but the said hand process prepares an article realising 80*l.* per ton; therefore, to do it for 25*l.* hand labour must be avoided. The substances to be got rid of are gum and tannin matter, both being soluble in water, and I find that by soaking the grass for a few hours when fresh and green in pure water (a running stream is preferable), by placing the grass in a wooden or other crate with bars or spokes on all sides, and with a moveable lid or cover to rise and fall by means of a lever or lift, and wash out by pressure the adhesive matter whilst in the water. The bottom of the box may also be made to rise and fall, to give equal effect and pressure to all the plants. This method would not hurt the fibre in general if the bars be so adjusted as to press between each other, and not on each other, and would thoroughly effect the object at lowest possible cost. I have tried the plan myself sufficiently to test its effect. If the whole of the gum be got rid of then the rest of the operation is easy by drying the plant quickly in the sun, and then treating it with the ordinary machinery used by European manufacturers.

Fenchurch-street, Nov. 26.

GEORGE O'BRIEN.

VAN MINE.

SIR,—The freaks of lodes, especially champion ones like the above mine are possessed with, 60 ft. wide in places, are sometimes given to carry veins in them only dodged about, and to find one only extending, to say the least, at right angles, or similar to a breast head, would have to be opened from the foot to the hanging wall 60 ft., but taking an angle 40°, more or less, according to angle so much more of course. Even beyond this a side tie vein is liable to take off from the lode a few fathoms and come back again. Viewing these facts it must be proved beyond doubt to name a new lode by developing it sufficiently to be well off the run of the champion lode walls itself.—*Marazion, Nov. 26.* A. M.

DRY AMALGAMATION.

SIR,—My reply to Prof. Huntington's attack appears to have made that gentleman very angry. I am sorry that this is so; but, perhaps, under the circumstances it should not be a matter of surprise. It is a pity, however, that he and his friend Mr. Koch think it necessary to adopt the tone they have; they must bear in mind that I did not raise the discussion or court the publicity of the facts.

As to the question of manufacture, I do not suppose I shall much suffer because Prof. Huntington and his friend in their present mood think proper to imply that I seek to make unfair representation. The letter from my firm Mr. Huntington refers to is dated April 27, 1883, and the following is the text of it:—

"Having read in the *Mining Journal* a short notice of your process for extracting gold and silver from their ores, we applied to the Editor of that paper for further particulars, and he has referred us to you. We shall be exceedingly obliged if you will be good enough to give us any information in regard to this process, as we are very interested in such matters, and would have many opportunities of introducing it to friends engaged in mining operations."

(Signed) T. B. Jordan, Son, and Commins.

It will be understood that this letter was written when we knew nothing whatever about Prof. Huntington's amalgamator, and supposed it to be an original machine. The readers of the *Mining Journal* will see also that the letter does not contain a word about manufacture, as stated by Mr. Koch, neither had we any desire, nor did we indicate any desire, for any such arrangement; indeed, it would be scarcely reasonable to suppose that my firm should readily propose to manufacture a machine that it had not seen, and knew nothing of. The only remark relating to the manufacture in the correspondence is in a letter from Prof. Huntington to my firm, in which he asks me to call on Mr. Koch in reference to our suggestion as to manufacturing. This, it will be seen, is quite a different thing; but I suppose Prof. Huntington's explanation of the matter is his idea of fair play. I repeat most emphatically that it was first suggested by Prof. Huntington that my firm should go in for the manufacture of his machine. He contradicts me—well and good. The whole of the correspondence can be seen at this office. Without entering upon a longer proof, which could but be tedious to the readers of the Journal, I will only say that the pulveriser episode related in my last letter clearly shows the advantage Prof. Huntington expected to derive from his connection with my firm, whereas I could scarcely have anticipated any gain in "working for the benefit of all parties," in conjunction with Prof. Huntington's imitation of my firm's old amalgamator, illustrated in last week's *Mining Journal*.

The readers of the Journal will have noticed that the practical points of my reply have been carefully left without comment. However, independent of all arguments between us, the "survival of the fittest" will decide the comparative merits of the machinery (which, after all, is the only interesting and practical question), and I have no doubt that both Prof. Huntington's amalgamator and my process will find their own level of merit.

THOS. ROWLAND JORDAN.

Gracechurch-street, Nov. 26.

SHROPSHIRE LEAD MINES.

SIR,—Tankerville Great Consols miners, whom, it is well known were thrown out of employ suddenly some months ago with two months' wages due to them, have since then received 5*s.* in *l.*, and about six weeks ago were led to expect 5*s.* more; but hitherto the second 5*s.* has not been paid, but we trust it will be paid as early as possible, for many families are very bad off. We understand that the 5*s.* already paid was realised by the sale of lead ore and blende, and the 5*s.* now expected is realised by the directors calling up the unpaid calls of some of the shareholders. It is a wonder to many here that the liquidators have left the lead ore and blende broken in the last month, or a good part of what was broken in the month, to be covered with water. Some hundreds of pounds worth of ore has for the present been lost in this sort of way, and many families suffering severely.

MINER.

GOLD COAST, WEST AFRICA.

SIR,—I am pleased to see that the shareholders of some of the gold mines on the Gold Coast of Africa are bestirring themselves. The Akankoo and the Wassau have taken initiative in changing their home management, and have placed some men of mining experience on the board. This shows they do not mean to have their capital eaten up by men possessing no knowledge or capacity to direct mining enterprises. What is become of the Effuenta, Taquah, French Mine, &c.? A large amount of capital has been subscribed, but we hear nothing of their doings. It would be cheering to your readers to be made acquainted with the state of matters, especially now that this part of the country is so well known to consist of some of the finest and most productive quartz, and being one of Great Britain's colonies is a great protection to capitalists. There ought to be no difficulty in extracting the gold, particularly as some of the new inventions for gold amalgamators, which guarantee to realise 90 per cent. of the gold, however fine it may be, at the small cost of 1*s.* per ton, and are open to treat on terms of percentage being dated. This is a great consideration, the losses generally being estimated at 40 per cent. or 50 per cent. There would be no difficulty in raising sufficient capital if these matters were in the hands of practical men of business to ensure confidence. I am anxiously looking out for some report from your correspondent, Mr. Gowan, who appears the only person who gives any information as to what is being done on that Coast.

Allow me to suggest that the subscribers to the Gold Coast mines generally should have a meeting of the shareholders, to compare notes and arrive at some definite plan of action of co-operation. In the first place, urge upon the Government to grant a subsidy for a

light railway, say, from Axim, some 50 miles up through the gold region; it would not only encourage the development of the gold mines, but also increase the produce of ivory, gum, copal, monkey-palm, oil, &c., exported into England (gold being the chief export for centuries). This coast, of all others, is the region of the oil-palm, where it grows in great profusion. As West Africa is the subject of the day, it beholds us to awake to increasing our trade in this quarter of the globe as one, is not the most promising. A line of railway could be made very cheap, having all materials on the ground, iron excepted; the district includes an area of some 16,820 square miles, and a population of over 520,000. The line will pay well.—*London, Nov. 27.* E. W.

DEPRESSION IN TRADE.

SIR.—This is a subject which is not only causing much discussion, but at the present time is undoubtedly severely felt in many parts of Great Britain and Ireland, while pressing heavily on a large section of the industrial classes. As to the causes that have brought about a state of affairs which may be termed stagnation of trade, they will be ascribed by different ways and means, according to the ideas of the writers or operators on this topic, and the experiences gained by them in the walks of life they occupy. Whatever may be the real causes of depressed trade one source of congratulation that all may be thankful for is—that the necessities of life are cheap, plentiful, and easily obtained. The chief consideration of human energies should be devoted to the plentiful supply of food, and other essential necessities of life, as also the providing for those comforts and luxuries which increasing intelligence, and the requirements attending the march of improvements, renders now a necessity what at one time might have been termed a luxury. The English nation and her dependencies have enjoyed an unexampled career of prosperity for the past 30 years, to which other nations, excepting America, have not been so accustomed, and now that a wave of depression in trade, commerce, and industries, has spread its influence over the land it may not be out of place to state what my impressions on the subject are, and in what way the current of industries, or the production of wealth, may be turned to give a steady and permanent increase to the prosperity of those industries, which now labour under depression.

That over production in many articles of trade, and the keen competition of other countries which are becoming the manufacturers of various classes of goods of which England had almost possessed a monopoly, and the inundating of the markets with such a variety of articles of trade that are not really necessities, have been partly the means of bringing about depression in trade there can be little doubt. There are other causes also on which the trade, commerce, and industries of England and her dependencies are in a very great measure dependent for support, and probably the most important is that of "our gold supply." The gold discoveries of California and Australia opened up a new era in the history of the world, and new fields of enterprise for development and the permanent extension of trade, commerce, and industries. The fortunate discovery of gold came like a beam of sunshine upon the world from two different points of what was then known as the uttermost parts of the earth; these two lands flowing with veritable "milk and honey," or what is of more practical purpose, teeming with untold wealth, not only in a fruitful soil and delightful climate, but permeated with a mineral wealth in gold and silver that has proved so productive in extent that the new purchasing power raised from the alluvial gravels and quartz reefs to the amount of nearly 1,000,000,000 sterling in hard cash has been distributed by the miners throughout the channels of trade and commerce of those countries that have commanded the trade and supplied the requirements of those gold-producing countries.

There are many who ascribe the great prosperity and increased wealth during the past thirty years in England to Free Trade and the increased introduction of steam-power to the aid of commerce and industries; but while each of these causes have borne their part, the one prime factor which has not been, or is seldom, taken into consideration sufficiently is "our gold supply." This great and important element to the increase of wealth, comfort, and happiness, its resources and means of development have hitherto been treated only with scant courtesy in proportion to the effect it has had on the extension of finance, trade, commerce, and industries, and those other sources and forms of wealth which constitute in its aggregate national prosperity. Depression in trade means the want of more gold or a more lively circulation of coin throughout the various channels of industry. "Our gold supply" can only be increased by and from one source—that is, by gold mining.

The effects of gold mining, or the production of new gold, appears to be but little understood. It has become one of the most important industries of the world. It creates new wealth or purchasing power, and it is the direct acting means of opening up new avenues of industry and trade, which, but for it, would not be known or required. It has the same effects on all kinds of financial, commercial, and industrial pursuits of the world as steam has on locomotion. Gold and silver being the precious metals adopted as specie, or as a medium of exchange and currency for regulating the value of other commodities for the use and benefits of mankind—they being, in fact, the axis on which revolves the finance, trade, and commerce and general business, as well as the pleasures and necessities of every-day life—it is of the utmost importance to all that their production, as also the results and requirements of gold mining, should be made subjects for consideration and discussion more than has hitherto been done.

The discoveries of the gold fields of California and Australia were a fortunate if not a Providential circumstance to relieve the general depression then existing, by opening up new countries for settlement and avenues for the profitable employment of labour, the development and increase of new capital for the benefit of a large portion of the civilised race. The production of new gold from the earth has a more direct and immediate effect on the prosperity of other industries than has the production of any other kind of wealth of a relative computed value to a similar amount. Thus, any given quantity of new gold raised is not only so much more money in immediate circulation, but it is also the basis from which radiates additional capital in the shape of credit or paper currency that is issued and recognised as money on the basis of gold. During the years from 1851 to 1861 the gold supply from the newly-discovered gold fields of California and Australia was of the enormous amount of 282,829,000*l.*, by far the greater portion of which gravitated to England through the channels of finance, trade, and commerce, as England commanded not only nearly the whole of the Australian trade, but also a large portion of that to California—the latter gold fields supplying 118,800,000*l.*, and the Australian gold fields about 104,029,000*l.*

This vast acquisition of new wealth to England's financial and trading resources created a proportionate increase in manufacturing industries, and stimulus to commercial enterprise with the most satisfactory results to the nation. During the next decade, from 1861 to 1871, there was a gradual decline in the yields of gold, the total being 222,565,000*l.*, the production from California and other States of America being 94,950,000*l.*, whilst the Australian and New Zealand gold fields, and a few other places produced 127,415,000*l.* From 1871 to 1881 there was a further decline to 194,540,000*l.*, of which the United States of America contributed 77,318,706*l.* Although the American gold production had also declined their production of silver during that period reached enormous proportions, amounting to 75,934,450*l.* With the vast mineral resources of the Australian colonies and America there need be no fear of exhaustion of a gold supply; with increased attention to the industry, the use of improved appliances, and the judicious direction of capital and labour, there is no reason why the gold supply cannot be materially increased and permanently maintained to meet the increasing requirements of nations and individuals.

In the United States of America, notwithstanding the enormous production of gold and the influx of population up to 1861 the development of their manufacturing power was scarcely appreciable. Since the establishing of a protective policy by Congress the outflow of gold from America to England for the payment of British manufactured goods soon materially decreased, and a corresponding

and remarkably increased prosperity in all branches of industry in that country soon followed. The discovery and development of the silver mines since 1861 has not only added largely to the wealth of the country in coin, but materially aided the development of other industries incidental to, and more or less dependant on, our gold and silver mining. The total production of the precious metals in the United States of America since their discoveries being about 450,000,000*l.*

British trade with her colonial possessions, and especially the Australasian colonies, is that on which the great future for expansion and development should be directed, and from whence the future supply of gold for the benefit of British trade, commerce, and industries, must be dependent. Nearly the whole of the gold supply from the Australian colonies, amounting to about 300,000,000*l.*, has, during the past 30 years, been poured into England, thereby increasing her national prosperity in absolute wealth of coin, extending her financial resources, and developing trade, commerce, and industries, in such a way that would have been impossible without the aid of that "gold supply." The prosperity of British trade, commerce, and industries, must in a great measure be regulated by, and be dependent on, the production of gold from the Australian colonies, and the attention given to the legitimate development of the gold mining industry, as it is only by the success of that industry that the indispensable article of real wealth, for which all people, nation, creeds, countries are striving for—gold—can be obtained.

As there is ample room for the employment of tens of thousands of enterprising and industrious men in the development of the mineral resources of the Australasian colonies and the profitable investment of capital, it will be found more advantageous for British capitalists to give more attention to aid the further development of those colonies from which they have derived so large an accession of their wealth, where their capital is safe from loss, and with greater certainties of larger profits than can be derived from foreign investments. Now that gold mining where understood is a recognised industry and legitimate business, and, as can be verified, is not only one of the most important but the most profitable industry in the world, it is essential that the question of our gold supply should receive more intelligent consideration than it has hitherto done, and the merits of the industry should become better understood.

THOMAS CORNISH, Mining Engineer.
Author of *Our Gold Supply; its Effects on Finance, Trade, Commerce, and Industries.*

FOREIGN MINING AND METALLURGY.

Prices have shown weakness in the French Iron Trade, steel has commenced the downward movement, and iron has followed suit. Whatever the future may have in store the present wears a sombre aspect. There has been no important change in the German iron trade. It is noticed, however, that the demand for pig has become a little more active in Germany, in sympathy probably with the rather more favourable news received from the English and Scotch markets. The deliveries of pig have kept pace with the production fairly well, but prices have still been scarcely remunerative, although the cost of production has been reduced as much as possible. The demand for German pig upon foreign account leaves something to be desired, except for spiegel pig, which has been in much request. Bessemer, Thomas, and refining pig have remained without change in Germany. Spiegel pig containing 10 or 12 per cent. of manganese has been quoted at 2*l.* 10*s.* to 2*l.* 11*s.* per ton, for pig containing a larger proportion of manganese the rates have been 1*s.* to 1*s.* 6*d.* per ton higher. The minimum price of Bessemer pig from Westphalia has been 2*l.* 11*s.* per ton, Thomas pig has been quoted as low as 2*l.* 2*s.* per ton. Rolled-iron has maintained previous rates very well in Germany, the demand has been steady, and most of the rolling-mills have work, although the foreign demand is not so active as could be wished. Steel rails have remained at about 7*l.* per ton in Germany.

The general condition of the Belgian iron trade is not at all encouraging. Orders have continued scarce of late, and as the existing depression has been of long duration it is felt all the more severely. Industrials show no disposition to despair; on the contrary, they struggle bravely on, but the orders which come to hand are obtained upon terms which leave scarcely any profit. Casting pig from Longwy and the Grand Duchy of Luxembourg has made its appearance at Charleroi, or, at any rate, in the Charleroi basin. The Athus Works have shown a disposition to resist this state of things by reducing their rates. The Athus Works are the better enabled to do this, as their production of refining pig has been sold in advance for the first quarter of 1885 at 17*l.* 15*s.* 2*d.* per ton. English casting pig has been selling upon the Belgian markets at 2*l.* 2*s.* 6*d.* per ton. No. 1 Belgian iron has continued to be quoted at 4*l.* 10*s.* per ton for exportation, and at 4*l.* 12*s.* per ton upon home account. No. 2 has remained at 4*l.* 16*s.* per ton, and No. 3 at 5*l.* 2*s.* per ton. Girders have been dealt in at 4*l.* 16*s.* to 5*l.* per ton. The Athus Steelworks are now in operation only one or two days in each week; but it is not correct that they have completely stopped, as has been reported in some quarters. Contracts have just been let for some additional rolling-stock required upon the Belgian State Railways. The Angleur Steelworks will probably supply the tyres and a part of the axles.

With the approach of winter the weather has become much colder in Belgium, and the Belgian coal trade has shown considerable firmness in consequence. Several collieries in the Liège basin have commenced the winter season by making an advance of 10*d.* per ton in household coal; and, taken as a whole, quotations have been firm and well sustained. No actual advance has taken place in the Centre district, but quotations have shown a firm tone. Coal for metallurgical purposes has not sold at all freely. The Couchant de Mons has not attempted any advance in prices, but has steadily maintained former rates. The number of trucks carrying coal and coke which passed over the Belgian State lines in the week ending Nov. 16 was 20,663, as compared with 21,673 in the corresponding week of 1883. The tone of the German coal trade has been firm; at the same time, business has shown no indications of the increased activity which is usually looked for this season of the year. Deliveries of coal from Westphalia by railway have continued active; but the waters of the Rhine have been so low that there has been a marked slackening in the commercial movement over the river. The company known as the United Collieries of the Charleroi Basin has just issued its annual report and accounts, which are brought down to June 30. The profits of the year are returned at 7941*l.*, admitting of the payment of a dividend of 7*s.* 4*d.* per share.

TECHNICAL JOURNAL AND INDUSTRIAL SELF-INSTRUCTOR.—To judge from the advance copy of the first part of this periodical, Messrs. Ward and Lock, the publishers, will, without doubt, surpass anything of the same kind hitherto issued, and for aspirants to the certificates of such establishments as the City and Guilds of London Technical College we know of no work that will at all compete with it. In the present work there are chapters on the Carpenter and his Technical Work, the Calico Printer, the Stonemason as a Technical Worker, the Ornamental Draughtsman, the Factory or Mill Hand as a Technical Worker, the Machine Maker or General Machinist, the Young Architect or Engineer, the Grazier and Cattle Breeder and Feeder. There is a supplementary section containing practically useful notes, technical news, and correspondence; and likewise eight pages of the Cyclopaedic Technical Dictionary, which is so printed that it can be detached from the other part of the number and bound separately, so that it will form what promises to be one of the best works of technical reference extant. The work differs essentially from the popular instructors previously issued, and the only doubt that could arise is as to whether the enormous expenditure which will have to be incurred to bring together such information, and in such a style, will be covered even by the enormous circulation which the Technical Journal is sure to obtain.

AURIFEROUS WEALTH OF NEW SOUTH WALES.—It is estimated that the area of gold land in this colony amounts to 70,000 miles or 44,800,000 acres.

THE COPPER INDUSTRY OF THE UNITED STATES.

The rapid extension of the railroad system in the Rocky Mountains has, as may naturally be supposed, had a stimulating effect upon the mines of Western America, and, among others, those for copper are being vigorously worked. Their future prosperity hinges, however, upon the efforts brought to bear upon cheapening the cost of production at a more rapid rate there than in rival countries possessing great natural advantages, ample backing of capital, and large experience. The following particulars of the copper industry are gleaned from Professor Kirchhoff, jun.'s, report to the Geological Survey of the United States. The history of copper mining on Lake Superior records many disastrous failures and a few striking successes. The vicissitudes of the many enterprises started have been fully developed by Messrs. Charles E. Wright and C. D. Lamton in the reports of the Commissioner of Mineral Statistics of Michigan for 1880 and 1881. The native copper in the Lake Superior district is found in veins, in masses, or scattered more or less uniformly in small quantities in two classes of rock. The "mass" mines in which the native copper is found, unequally distributed in bodies weighing from a few pounds to hundreds of tons, were those which, in early times, established the reputation of the district. They have now ceased to be of much importance, the principal ones as producers being the Central and Phoenix, and even they depend largely upon the crushing of lower grades of rock. The opening out of a vein of fair grade ore is nowadays of much greater importance to the copper trade than the discovery of a series of masses. The principal deposits from which the bulk of the copper of the Lake is obtained are the so-called "amygdaloid" and "conglomerate" beds, rocks in which the copper is finely distributed in small grains. These are separated by stamping and crushing, yielding a product called "mineral," or copper mixed with a varying proportion of gangue of iron, and of moisture, yielding from 40 to 90 per cent. of ingot, a lower grade being recently made.

The treatment of the ore from the two classes of veins does not differ in details, but there is a wide variation in the cost of treatment, due to the fact that the rock from the conglomerate veins is much harder, so that it is profitable to work much poorer rock from amygdaloid beds. Among mines working conglomerate beds the Calumet and Hecla is most widely known as the greatest producer, and by far the most profitable undertaking. With a splendid plant, paid for out of current earnings, it is in a position to produce copper, and place it on the markets of the world at a lower rate than any known mine. This mine is exceptional as to its capacity to turn out large quantities of copper at a low cost. Statistics show the reduction in cost due to the introduction of modern improvements in Lake Superior mines, and also indicate how large a proportion of the mines of that district are capable of being worked without loss at the low prices for the metal now ruling. For many years the history of the copper trade has practically been a record of the movements of consumers and producers of Lake copper. The fact that by far the greatest portion of the product of the country has been drawn from that region has, until a very recent period, given it the controlling influence in our markets. Of late years attention has been directed to the development of the undoubtedly great copper resources of Arizona territory, and in spite of the depressed state of the market enterprises in this direction are looked upon with much favour. From 1866 to 1869 considerable work was done at William's Fork, but from that time from various causes mining in the territory was at a standstill until 1873, when the Longfellow Mines, in the Clifton district, were started. In September, 1880, the Copper Queen Company started work, and the following year witnessed a series of developments in the Globe district, at Pinal, and in other sections of Arizona. It is impossible to speak in general terms of the conditions affecting the copper mining industry of Arizona; they vary so much according to locality, and they are not concentrated in well defined districts. The ores of Arizona are almost exclusively carbonates and oxides, not carrying enough silver to make its extraction profitable. As yet in most of the mines a sufficient depth has not been reached to develop notable quantities of sulphurets, and until that point is arrived at a falling off in the production need not be looked for. The three principal centres of the copper production of Arizona are Clifton, Bisbee, and the Globe districts. Montana, though not equal to Arizona as a producer, can boast of the most important district in the country outside of Lake Superior.

Almost the whole of the output of Montana comes from a small number of mines in the immediate vicinity of Butte City. The copper deposits of Butte are a series of wide veins carrying argentiferous copper, sulphurets, and, sufficiently large quantities of silver to bear the cost of separation, and leave a profit. The wealth in copper of the New Mexico Territory is great, and a number of enterprises had fairly begun work during the latter part of 1882, and others have since been started. California at present plays an important part in copper mining, but there is no doubt that there are numerous deposits along the foothills of the Sierra Nevada. Copper is found in many sections of Colorado, but the production from any single locality is limited. The mines at the towns of Central, Black Hawk, and Nevada, are the largest producers, the ores being a sulphide of copper and iron, carrying gold and silver. Quite recently the deposits of copper north of Canyon City have received considerable attention, and the mines in that locality are now regularly shipping oxidised copper ores. The copper produced from Colorado ores is more or less injured in quality by small quantities of tellurium, arsenic, antimony, bismuth, &c. During the past few years Utah has come forward as a copper producing territory. The principal work done thus far is in the Tintic district, and the Ewing and Beaver districts. The latest territory to assume a rank in the list of copper producers has been Wyoming. Vermont has been the steadiest copper producer in the East. Recent efforts to introduce modern methods of smelting and concentration have not as yet been carried into effect, chiefly because of dissensions among the parties interested.

CONDENSING SULPHURIC ACID GAS.—An ingenious, though somewhat complicated, apparatus for the condensation of sulphuric acid gas has been introduced at Roszdin, in Silesia, and found to work very satisfactorily. The sulphurous gases from the calcining-furnaces are taken to a lead-lined tower packed with coke, flints, or any other suitable material in the usual manner, down which water trickles from a cistern on top of the tower; the water absorbs the sulphurous acid gas, and also the sulphuric acid and soluble sulphates that may be carried over from the calciner. It then flows out of the bottom of the tower, and is taken through a lead pipe to a series of closed shallow lead pans, a dozen in number, arranged one above the other in a fire-brick chamber, through which pass the hot gases from the calciners on their way to the condensing tower. The lead pans communicate with each other by lead pipes, placed in diagonally opposite corners, and arranged so that the liquor is taken out from the top of each pan, and flows into the bottom of the pan below it. The hot gases passing around and between the pans cause the liquor to leave the lowest pan at considerable heat. This hot liquor then rises through another lead pipe to the top of a smaller tower, of cylindrical shape, and lined with lead, in the centre of which revolves a shaft covered with lead, and having several discs of lead attached to it. These discs, revolving on the shaft, alternate with fixed ledges or shelves on the sides of the tower, and as the liquor flows down in a cascade over these ledges and discs it is broken up into very fine spray. At the same time a current of hot air is passing up the tower, and takes up and carries away the sulphurous acid gas that is liberated from the hot spray. It is drawn off from the top of the tower, and led away to a sulphuric acid chamber, or other point at which it may be desired to further operate with the sulphurous acid. The hot liquors that have thus been freed from the sulphurous acid taken up in the condensation tower flow into a long closed cistern of lead, through which pass a large number of lead tubes, arranged like a surface condenser. The air that is to pass into the spray tower is first forced through these tubes, which are surrounded by the hot liquor, and is in this way warmed. The apparatus is so made that the pipes expose sufficient surface to completely cool down the liquor, which then leaves the cistern, and is pumped up to the top of the condensation tower to

again absorb sulphurous acid, &c., and perform the same round. The warm air from the lead tubes is taken through heaters, which are exposed to the hot gases coming from the calciners, and being thus made quite hot passes into the spray tower as described. By continually circulating in this manner the liquor finally takes up a considerable amount of sulphuric acid and soluble sulphates, and when sufficiently concentrated a portion is drawn off, and is evaporated down in lead pans, a corresponding quantity of fresh water being added in the condensation tower.

THE NICKEL RESOURCES OF THE UNITED STATES.

The use of nickel in the industrial arts has rapidly extended of late years. This is owing to the peculiar nature of the metal which, possessing great strength and whiteness, rendered it a very good substitute for silver spoons and forks, and silver ware generally. But perhaps the largest use to which it is now put is for electro-nickeling and for small or subsidiary coins. The following abstract of a report on this metal by Prof. W. P. Blake for the United States Geological Survey may, therefore, be of interest:—Nickel, next to iron, is one of the most universally disseminated metals, yet notwithstanding this universal distribution, and the apparent abundance of this element, it is only a few years since the metal was first separated from its impurities in commercial quantities. In the United States nickel ores occur in moderate quantities in close association with chrome ores in the serpentine rocks from Canada to Maryland, and equally so with the chrome ores of the Pacific Coast, notably in Oregon. The element is also found to be closely associated with iron terrestrially as well as in meteorites. The ancient rocks of Michigan and the Lake Superior region are also found to contain many deposits of nickel; but none have yet been worked with commercial success. In New Mexico there are localities which it is said will furnish considerable quantities of 8 per cent. ore. The most abundant ore of nickel is in the form of a mixture with pyrrhotite or magnetic iron pyrites, which is found more abundantly in the older crystalline rocks than in those of later formation. The presence of nickel in the serpentine rocks of Pennsylvania, associated with chrome ores, is well known by the beautiful green crusts on the massive chromite quarried at Wood's Pit for the manufacture of bichromate of potash at Baltimore.

The most available ore of nickel, and the only one worked up to this date in the United States, is the sulphides occurring in connection with magnetic pyrites. Although the amount of nickel rarely exceeds 3 per cent. the quantity of ore is so large, and the sulphide ore is so readily smelted or enriched in nickel by roasting and matting, that it is the most economical ore to treat for nickel. The principal localities where this metal is found are in Connecticut and Pennsylvania. The locality at Chatham, Connecticut, about 6 miles from Middletown, yields both nickel and cobalt in combination with arsenic and sulphur. It is not now worked, but was one of the first places explored for metal in New England. The mine has been worked with varying success by different proprietors for a considerable time, the last attempt being made by the Chatham Cobalt Mining Company in 1853. This company made a good display of the ores and products at the International Exhibition, New York, 1853; but the second annual report, though very complete as regards the amount of machinery and facilities for working, brought together during the 18 months after the organisation, is silent as regards the production, which it may be assumed was comparatively insignificant, and the enterprise was soon after abandoned. At Lancaster Gap, Pennsylvania, is situated the only mine which has exerted an important influence on the development of the metallurgy of nickel in the United States. The lease was taken up by Mr. Joseph Wharton, of Philadelphia, Jan. 1, 1863, who finally purchased the property May 6, 1867, and who is now the only producer of metallic nickel in the United States. The ore of Lancaster Gap is the nickeliferous pyrrhotite, containing in bulk from 1.50 to 2 per cent. of nickel. It is enriched at the mine by smelting into a matte containing 10 per cent. or more of the metal, in which condition it is taken to Camden, New Jersey, for extraction. The works for the extraction of nickel from the Lancaster and other ores were first started in Philadelphia, and in 1853 Messrs. F. M. Buck, E. W. Coffin, and others erected nickel works at Camden, supplying them with ore from the Gap Mine. Mr. Wharton leased the Camden Works in 1863, and purchased them in 1869. A large portion of the metal produced by Mr. Wharton has been used at the United States Mint for the subsidiary small coins, and since the development of nickeling by galvanism a large part of the product has been put into the form of nickel salts and anodes.

The recognition of nickel as an element dates no further back than 1751. Before that time it had been found as a troublesome residue, but was supposed to be a mixture of cobalt and copper with arsenic. For a long time nickel was not known in a pure state, and although the impure alloy was largely used to make what was commonly known as German-silver, the valuable properties of the metal in its pure state were unknown. The impure nickel or nickel bronze carried with it into the German-silver all its noxious associates. Even 1 per cent. or less of arsenic was sufficient to greatly modify the physical properties of the nickel or the alloys made from it, consequently the difficulty in freeing it from such small quantities of impurity resulted in preventing it from being commercially known. Experiments, however, conducted by various chemists resulted in solving the difficulty, and now the refining of nickel is largely and successfully carried on by the Vivians of Swansea, and others. Dr. Fleitmann, of Iserlohn, Prussia, has done much to improve and cheapen the process. He has also succeeded in welding sheet nickel upon iron and upon steel plates so as to coat them equally on each face with a layer of nickel. The physical properties of the two metals, iron and nickel, are so nearly the same that they work well together, and they adhere tenaciously. The application of such nickelled iron sheets in the arts will readily suggest themselves, and this new application of nickel constitutes practically a new industry of great importance. It increases the consumption of nickel, and will stimulate its production, and by giving a steady demand will no doubt lead to a more uniform and constant supply.

THE VERY OUTER CIRCLE RAILWAY.—Previous to the Franco-Prussian war the only doubt entertained by the majority of Frenchmen was whether Berlin was on the Rhine or on the Moselle; and had not the hated city been far away on the Spree, the French army might have found its way there. Even now there are many Frenchmen who are by no means certain whether the Mediterranean or some other sea separates their native land from England. About an equal amount of regard for geographical facts and difficulties is shown in the proposition recently made in France for a Direct Anglo-Indian Railway since the route proposed is Paris, Madrid, Gibraltar, Tangiers, Tunis, Tripoli, Cairo, Bassorah, Kelat to Kurachee and Bombay. The nominal capital is fixed at 10,000,000*l.* It is intended to profit by the existing railways in France and Spain, and to establish a steam transit from the Bay of Gibraltar to Ceuta, in Morocco. From this latter point would begin the International Railway, the works of which would have to be constructed in Morocco. This line would form a junction with the system of railways under the administration of the French Railway Company in Algeria and Tunisia, giving communication from France to the various lines and branches in those provinces. It is then proposed to continue the route through Tripoli to form a junction with the Egyptian railway system. From Egypt the route to India would be continued to reach the Enphrates, and then along the coast of the Persian Gulf to the port of Kurachee, in India. At that point the great Indian system of railways would be reached, communicating with Bombay, Calcutta, and Madras. The entire line from London to Bombay has been calculated to extend over a distance of under 7000 miles, and this distance, it is said, can be traversed in nine days at the average rate of 35 miles an hour.

CURES OF COUGHS AND COLDS.—Received (this day).—"I have sold Dr. LOCKE'S PULMONIC WAFERS for years, and always recommend them in preference to any other cough medicine. (Signed) R. E. Warrior, M.P.S., 75, Overbury-street, Edge Hill, Liverpool." They instantly relieve and rapidly cure asthma, consumption, bronchitis, coughs, colds, shortness of breath, phlegm, &c. in the chest, rheumatism—and taste pleasantly. Sold at 1*s.* 1*d.* and 2*s.* 6*d.* per box, of all druggists.

AMERICAN PATENT LAW.

An important amendment to the rules governing the practice of the United States Patent Office has, says the Washington correspondent of the New York Iron Age, just been promulgated. It has heretofore been the practice of the Patent Office, in the case of two applications found to interfere, to notify each applicant of the date of filing of the other application. It must be remembered that an interference is in the nature of a lawsuit—a contested case—the purpose of the contest being to ascertain which of the parties was the prior inventor. Other matters may intervene which may be exhibited by the testimony, such as public use, want of due diligence, abandonment, &c. But the main question is that of priority of invention as between the parties. To begin such a suit it is necessary that each party should be advised of the other's purpose. But it is claimed by the officials at the Patent Office that there can be no valid reason presented why any party should be advised as to how far back an invention had been made in order to overcome the date of the rival applicant. An interference proceeding is begun by a so-called preliminary statement which is in the nature of a declaration. The information which it is desired that this statement should cover is independent of anyone else when the party making it concedes embodied and reduced to practice the invention applied for. As was remarked by a Patent Office official, "It seems absurd to set up another person's case at the outset, and before proceedings begin to indicate to that party how far back at least he must swear." Recognising this fact, the rules have been amended by Acting Commissioner Dyrenforth, omitting information as to the date of filing of an interference application. There are some other amendments to the rules, which will also appear. Thus, if an application had been assigned, and the application is in interference before the applicant disclaim any portion thereof, it is made obligatory on him first to obtain consent of the assignee.

The Patent Office promulgates for the information of inventors the recent decision in the United States Circuit Court, Southern District of New York, in the case of *Milligan v. Lalance and Grosjean Manufacturing Company*. The principles involved and questions settled are presented as follows:—1. Where the evidence rested almost wholly in parol, and there was enough on either side to warrant a finding that way if there had been none on the other, and the determination of the question depended upon the credibility of the witnesses, held that the question was within the peculiar province of the jury, and unless it appears that they did not consider the question fairly, and decide it according to their best judgment, the Court has no disposition or authority to review their work.—2. Where a patent covers vessels having both a shoulder and wire, and the inventor did not invent the wire, the act of the solicitor inserting it would seem to be unauthorised, and the patent as to the public void.—3. The real question now is whether the fact of the invalidity is a good answer to this action upon the contract. The defendant has had and enjoyed what was contracted for, and it is no answer to say that the same might have been had without the contract. The defendant could not both stand upon the patent and repudiate it, nor upon the plaintiff's title and repudiate that. In the result *Milligan's* patent was declared void.

Another recent decision in the same court, and regarded as of sufficient importance to receive special promulgation by the Patent Office, is that in the case of *Hicks v. Otto et al.*, the points involved being as follows:—1. Reissued letters patent No. 10,189, granted Aug. 29, 1882, to James Joseph Hicks, assignee of Luigi Peroni, for a magnifying thermometer, the principle of which is the placing of the bore of the thermometer in rear of or beyond a magnifying curve or surface through which the bore is to be viewed, declared valid.—2. A patent reissue, which claims more specifically and clearly describing the invention, is valid, although applied for more than two years after the date of the original patent, and although the original claims in connection with the specification were capable of the same construction as the claims of the reissued patent.—3. The fact that a patented article immediately on its introduction was successful in the trade is evidence of invention.—4. The fact that an alleged anticipating device made no impression on the trade, and was not a practical success, indicates an abandoned experiment.

The following reply of the Acting Commissioner of Patents to an attorney making application for a patent will explain itself:—It is repeated that the application is rejected upon the ground that the devices as explained are inoperative for the purpose intended—that the application lacks utility and importance. I understand the proposition of the attorney to be, that the Patent Office cannot refuse a patent upon the ground that the apparatus involved is inoperative. This position is entirely untenable. Lack of utility or of value and importance is a statutory ground of rejection, and we should soon write ourselves down as asses if we were to patent every conceivable thing simply because there might be nothing like it, and ignore any question as to its operativeness. A chimerical device for bottling moonbeams might be entirely new, but I doubt that any examiner in the Patent Office would allow it to go to issue. So a device for producing perpetual motion might be essentially novel, but, if it were recognised as such a device, I am convinced that no examiner, in the light of the American patent system, and with the wholesome training acquired in the Patent Office, would allow it to become a patent if he could prevent it.

In the Supreme Court of the United States a decision has been rendered in the important patent case of Benjamin Butterworth, Commissioner of Patents, plaintiff in error, against the United States *ex rel.* Richard H. Hoe and others, in error to the Supreme Court of the District of Columbia. This was a suit brought for the purpose of obtaining a writ of mandamus to compel the Commissioner to issue a patent in accordance with his own decision, notwithstanding the fact that that decision had been overruled and reversed upon appeal by the Secretary of the Interior. The question presented here is whether any right of appeal exists in patent cases from the decision of the Commissioner to the Secretary of the Interior. The Court, in a long and carefully prepared opinion by Justice Matthews, holds that an appeal does not lie in patent cases to the Secretary of the Interior; that the Commissioner of Patents has the exclusive right to decide for himself whether or not a patent ought to issue, and the Secretary of the Interior has no authority to review such decision. If the Commissioner errs the party aggrieved has a statutory remedy, but that remedy is not an appeal to the Secretary.

RADIANT MATTER IN EDISON LAMPS.—At the electrical exhibition, Philadelphia, was shown a striking phenomenon. Midway between the two wires which carry the current to the carbon filament of an ordinary incandescent lamp a third wire is inserted, which terminates in a thin strip of platinum extending up midway between the branches of the loop, with its faces turned toward them, and ending about $\frac{1}{4}$ in. below the crown of the loop. When the lamp was in action at its ordinary state of incandescence, if a circuit was closed through a galvanometer between the insulated terminal of the platinum strip, and either terminal of the carbon filament, it showed a current flowing across the vacuum of the lamp, between the platinum and the carbon in opposite direction, according to which pole of the carbon was connected, but much stronger—40 times stronger—when the platinum was connected to the positive pole of the incandescent carbon; this through a galvanometer of about 20 ohms resistance. This current was increased when the current through the lamp was increased so as to heat it much beyond its normal temperature. After the lamp has been in use for some time the stronger positive platinum current becomes weaker, and, finally, changes direction. By letting the lamp rest the experiment may be repeated. The same currents were obtained through the glass when either terminal of the carbon was joined to a small piece of platinum stuck anywhere on the outside of the lamp. The same effects were also obtained when the bulb was drawn out into a long tube, and the connection made at its end, and when this tube was packed in ice to cool it down; but when the tube was bent round into a loop no current was obtained, probably from the cutting off of rectilinear radiation from the carbon. It would seem as if there were a field for extending Crooke's experiments on radiation.

MINING PROGRESS IN QUEENSLAND.

To all appearances the Etheridge gold field promises to become one of the richest and most successful in the colonies, but at present here, as in many other parts, the industry is checked by the want of railways for the cheap conveyance of the ore. The nearest port to Etheridge is Normanton, which is about 240 miles distant, and the expense of transport by wagons is a considerable item. The Charters Towers Mining Journal states that the field was opened in 1870 at Western Creek, where the diggings were alluvial. The first reef worked was named the Telegraph, and was opposite Georgetown. It was from 1 to 2 ft. thick, and crushed from 2 to 3 ozs. up to 6 ozs. of gold per ton on the water level, when it was abandoned. Another reef—the Livingstone, afterwards called the Papau—gave also payable crushing down to the water level. In the neighbourhood of the principal town on the Etheridge are the Lord Byron, Crown, Caledonia, New Zealand, and Durham reefs, all well defined, and which have averaged over 3 ozs. of gold to the ton. Three of these were flooded out with water, but two of them—the Durham and the New Zealand—are again raising large quantities of very rich ore. On the Rocky, 9 miles from Georgetown, is the Try-no-more reef, from which the parties who first worked it got an average of 11:313 dwts. to the ton, but they lost the gold and eventually split up. After three or four years two of the original party returned and restarted work, and lately a company has been formed, and it is reported the lost run of gold has been found.

Eight miles south of Georgetown are the Lighthouse diggings, with innumerable reefs and leaders averaging over 2 ozs. to the ton. There is a battery here of five stamps. The Cumberland, 14 miles from Georgetown, is turning out 2000 to 3000 ozs. of gold per month. Twenty-eight miles south of Georgetown is Charleston, better known as Finnigan's, and 12 miles south-west of that is Goldsmith's Creek. There are some very rich reefs at Finnigan's. The Marquis of Lorne is a mountain of quartz all more or less gold-bearing, and the Georgetown battery lately purchased is being erected there on a large dam, which has been constructed at the bottom of the hill. At Goldsmith's Creek the Caledonia reef, a different reef from the Caledonia near Georgetown, 12 ft. thick, averages 3 ozs. to the ton, and machinery is to be procured from home. Eleven miles north of Charleston lies Sandy Creek, where there is the Etheridge Gold Mining Company's machine. The Durham, 7 miles from Georgetown, has been recently taken up by a Melbourne company, and machinery is now on the road there. The Aurora, 9 miles from Georgetown, is 4 ft. thick, and looks very rich in gold; it has also only lately been taken up. Wonderfully rich assays have been obtained from mundic ore all over this field, and when cheap carriage will admit of the ore being properly treated, the returns will astonish the world.

Mining operations in the Wild river district have continued active. At Watsonville several abandoned claims have been taken up, with every appearance of success, confirming early scientific opinions that the deeper the mines the more tin will be unearthed. This district is a little over four years of age, and the quantity of tin ore that has been raised during that period is astonishing, yet no claim has reached a depth of 250 ft. A large outlay has been made at the Great Western, a still larger outlay is being made at Irvinebank, but the capital is being expended by individuals who know the value of money, and the value of the properties upon which they are expending it. Operations have ceased at the Silver Valley Silver Mining Company's properties at Newellton, and the New Zealand Tin Mining Company's mineral lease at Herberton is for sale by auction at Sydney. Upon the whole, the mining operations of the district never looked healthier, in fact, were never so assuring; the principal mines, and the lesser, as a rule, show progress with depth, and this is as satisfactory a manifestation as can be adduced. The Ballumba Smelting Company have established a purchasing branch here, and much of the tin from this district will find its way to Brisbane that previously went to Sydney.

ELECTRIC ILLUMINATION OF RAILWAY TRAINS.—Although ever since the introduction of the Faure storage battery the Brighton Railway Company have been using electric illumination in a Pullman express train, it is only within the past week that electricity generated by the motion of the train itself has been used for illuminating the carriages; they now supply the accumulators from a dynamo carried on the train. It is stated that by driving the dynamo off the axle of the brake-van there is practically no cost for power, probably 2 or 3 cwt. of coals being all the difference in a journey of 50 miles. For the past twelve months a train thus worked by a dynamo and a battery of 21 accumulators has been run upon the southern suburban line of this railway. The train has for the past month been re-arranged, and now supplies a current of 40 amperes and 42 volts; this sustains 40 incandescent lamps of 16 candle power, each distributed through the compartments of the 10 mixed carriages of which the train consists. Another very important feature in the train is the automatic arrangement by which the dynamo is brought into action. The electrical current passing from the dynamo to charge the accumulators must be of higher electro-motive force than that of the battery of accumulators, otherwise the discharge would overpower the dynamo, and have a tendency to burn it. To avoid this result the dynamo is normally kept detached from the battery, and is not brought into action until the train has attained sufficient velocity to drive the dynamo at the requisite speed. In the present instance, as soon as a speed of 20 miles is attained, a mechanical instrument connects the machine with the accumulators, and the charging of the batteries proceeds, but so long only as this velocity is maintained. The discharge of electricity in effecting the lighting is thus recouped during the runs of the trains between the stations, and the electrical plant is always maintained in a state of efficiency. Provision is also made for reversals in the direction of the train by an automatic arrangement, and the connections between the carriages permit of the train being made up with additional or fewer coaches. No electrician attends this train, the plant being left in charge of the guard. The train was started from the Victoria Station about seven o'clock for an official inspection by the officers of the Board of Trade on a journey to the Crystal Palace and back. The system adopted is the practical outcome of the labours of Mr. Houghton and Mr. Stroudley, and the train has been fitted by the Railway Electrical Contractors' Company.

WHAT PEOPLE READ IN NEW SOUTH WALES.—The Lending Branch of the Sydney Free Library contains 18,188 volumes, classified as follows:—Natural philosophy, science, and art, 2327; history, chronology, antiquities, and mythology, 1800; biography and correspondence, 2280; geography, topography, voyages, and travel, 2276; jurisprudence, 439; moral and mental philosophy and education, 951; poetry and drama, 532; miscellaneous literature, including prose fiction, 3546; patents, 4037. The volumes lent to readers for perusal at their own homes were as follows:—Natural philosophy, science, and art, 7138; history, chronology, &c., 5890; biography and correspondence, 6760; geography, voyages, and travel, 9862; jurisprudence, 1035; moral philosophy, &c., 2305; poetry and drama, 1620; fiction and miscellaneous, 38,804; patents, 6. These figures furnish an accurate index of the tastes of industrial Sydney, the greater number of borrowers belonging to the working classes.

UNIVERSITY COLLEGE OF NORTH WALES.—The financial statement of the University College of North Wales, which was opened at Bangor last month, has just been issued. The subscriptions promised are returned at 34,503*l.*, of which about 24,000*l.* has been paid. The annual estimated income of the College is 5000*l.*, and the estimated expenditure 5800*l.*, leaving a deficit annually of 800*l.* To meet this demand it has been decided to issue a special appeal to the Court of Governors.

IRON AND MANGANIFEROUS ORES.—Mr. E. S. FERGUSON (Cardiff, Nov. 26) writes:—The iron ore market continues in a dull condition. Sales of Rubio have been made at from 11*s.* 1*d.* to 11*s.* 3*d.* per ton c.i.f. Cardiff or Newport, with usual guarantees of iron. Freight from Bilbao to Cardiff or Newport is 4*s.* 6*d.* No 4 Forge Middlesbrough g.m.b. is quoted 40*s.* 6*d.* c.i.f. and No 4 foundry 41*s.* 6*d.*

THE RICHMOND GOLD AND SILVER EXTRACTING PROCESS.

Reference having been recently made in the *Mining Journal* to the new process for extracting the precious metals from refractory ores in use at the mines of the Richmond Mining Company a detailed description of it will be of general interest. The process is especially designed for the separation of gold and silver from arsenide and sulphides of iron and copper by the peculiar use of litharge or lead, when in a state of fusion, and the inventor—Mr. EDWARD PROBERT, of Eureka, Nevada—has included a method of stirring or agitation of the molten matter by the steam developed in the action of that mass upon the substances under treatment. The San Francisco Mining and Scientific Press states that iron pots, of a conical shape, about 30 in. deep, 30 in. wide at top, and rounded-off at the bottom spherically to about 12 in. in diameter, each capable of holding 15 cwt. (more or less) of the substance to be treated, are coated with a lining of refractory material, composed, preferably, of decomposed or pulverised lava, pumice, or other volcanic rock, but when this is not obtainable, of siliceous sand, with a certain admixture of finely pulverised limestone or calcareous marl, to which has been added a sufficiency of clayed water or milk of lime to work the whole into a paste. After laying on this internal coat of refractory material (intended primarily to protect the pot from corrosive action) to the thickness of about $\frac{1}{2}$ in., a further portion of a specially prepared composition, consisting of coarsely crushed limestone, dolomite, siderite, or other suitable carbonate, mixed with a sufficient quantity of ordinary composition with which the pot is lined to give it consistency, is laid on the bottom of the pot to the thickness of 1 in., more or less.

The pots thus prepared are placed in a suitable oven or chamber, or a small fire is placed inside each pot to dry coating, which, however, is not to be baked so as to expel the last portion of moisture, but only so far as to remove excess of water. When required for use pots thus lined and partially dried are placed in succession under spout of smelting furnace containing substance to be treated in a state of fusion, which is then tapped into them, while at same time, or immediately afterward, a charge of lead or litharge, preferably granulated, is fed into each pot from a hopper conveniently placed above.

First effect of molten substance tapped from furnace into pots is to convert small amount of moisture contained in protective lining of pots into steam, which, rising upward from bottom and sides, causes a brisk ebullition of molten material. This treatment is insufficient in itself to effect the thorough stirring and blending of the contents of the pot necessary to assure a successful result; but no sooner is this first ebullition, due to the escaping steam, over, than the limestone, dolomite, or other carbonate fixed in the bottom of the pot, as well as the calcareous matter in the whole lining, begin, under the intense heat of the molten charge to undergo calcination, and streams of carbon dioxide are sent off, which, rising upward through the molten matter, produce the effect of a small geyser. This keeps the charge in a state of ebullition and agitation for a period of time proportional to the quantity of mineral carbonate, or other source of carbon dioxide originally used in preparing the pot, and thus effecting such a complete blending and intimate admixture of the ingredients, as cannot be attained in any other way.

Duration of ebullition, and consequently of stirring process may be regulated to any required number of minutes, from five upward, or as long as the molten material continues hot enough to exercise a calcining effect on the limestone, &c., and inasmuch as the carbon dioxide produced comes off in a steady stream without sudden bursts, as from the vapour of water, there is never any danger to the workmen from explosions. After ebullition is over, the pot with its contents is set aside to cool, when the lead settles to the bottom, carrying down with it the precious metals, and, when solidified, the mass of alloy can be detached from the waste matter, and treated by cupellation in the usual way for the separation of the silver and gold. It will thus be seen that the stirring is effected partly by steam, which, however, can never be made to do the whole work, being too violent in its action, and causing trouble when too much moisture has been left in the composition, but chiefly by the carbon dioxide (carbonic acid, so called), developed during the calcination of the limestone or other carbonate employed as the source of gas or vapour.

MINING AND METALLURGICAL PATENTS.

Supplied by Mr. ERNEST DE PASS, of Fleet-street, E.C., Fellow of the Institute of Patent Agents.

Amongst recent applications for patents, in which the readers of the *Mining Journal* are more immediately interested, are the following:—

A. Harrison, Glasgow, No. 15,128, Apparatus for hammering steel ingots into slabs, blooms, or forgings.—Hugh Bain, London, No. 15,148, Tinning and finishing tin andterne plates, and machinery therefor.—W. Penman, London, No. 15,226, Treating cast-steel for effecting the annealing thereof.—B. W. Raine, London, No. 15,285, Manufacture of iron in puddling and like furnaces.—R. Inray, London, No. 15,358, Joint for lead or other soft metal pipes.—Dr. G. Wagner and E. Netto, Tokio, No. 15,365, Process and apparatus for electroplating, applicable for treating metallic surfaces by electrolysis plating.—Dittler and Co., Höchst-on-the-Main, No. 15,370, Process for the production of substances containing antimony.—S. J. Whitfield, Birmingham, No. 15,398, Mounting or covering with sheet metal the chill castings of metallic bedsteads.—J. A. Lloyd and A. Lloyd, London, No. 15,403, Metal boxes.—The Société Générale des Cirages Français, Paris, No. 15,405, Apparatus for tinning or coating metal plates.—La Société des Acieries de Longwy, Longwy, No. 15,409, Manufacture of iron and steel.—W. Ward, London, No. 15,436, Cutting off and shaping lengths of hollow or fluted wire.

The following selected specifications have been recently published, and are now open to inspection and opposition:—

APPARATUS FOR COOKING AND DISTILLING COAL.—C. E. Bell, Durham, No. 443.—Coke ovens are constructed with flues round the sides below the coal line to where the oven is loaded, and connected with a fan or exhauster for drawing a portion of the volatile products, whilst the products of combustion are conveyed away by a main flue.

BLAST AND CUPOLA FURNACES.—J. Swain, Oldham, No. 914.—Between the walls of the furnace a passage leads from the lower part of the same from below or about the level of the tuyere to the upper part of the cupola; the gases in a highly heated state are forced through this passage, and heat is thus imparted to the tuyeres, and consequently to the air for combustion.

APPARATUS FOR HEATING RAILWAY CARRIAGES AND OTHER VEHICLES.—W. R. Lake, London (a communication from M. J. Walsh, New York), No. 999.—Refers to a vessel made in two compartments, in one of which a heat-retaining substance is stored, and through the other is passed a jet of steam or other heating medium.

TREATING ORES OR SCORIA CONTAINING COPPER OR NICKEL, AND APPARATUS CONNECTED THEREWITH.—J. H. Johnson, London (a communication from E. Hermite, Rouen), No. 2157.—The ores or scoria are treated with a solution of ammonia in the presence of compressed air, the resulting liquid is subjected to electrolysis, for separating the copper and nickel.

COKE OVENS AND APPARATUS FOR COLLECTING AND UTILISING THE PRODUCTS OF COMBUSTION THEREFROM.—A. M. Chambers, Thorncliffe, and T. Smith, Chapeltown, No. 4708.—Heated air is forced into the upper part of the oven, and drives the products of combustion and gases downward through the mass of coal to a discharge pipe.

PROCESSES AND APPARATUS FOR DIVIDING AND DISTILLING CRUDE PETROLEUM, AND FOR REFINING THE PRODUCTS OBTAINED.—J. C. Mewburn, London (a communication from the Halvorsen Process Company, New York), No. 12,498.—The crude petroleum and benzine are mixed together and the benzine volatilised, whereby the primary oil is separated from the secondary oil. The secondary oil is subjected to fractional distillation. The distillates are purified by treatment first with sulphuric acid and afterwards with alcohol. When the primary oil is required to serve as a lubricant amyl alcohol and ethyl alcohol are added, the supernatant alcohol and lighter hydrocarbon being afterwards removed.

THE ASSAYS OF NICKEL AND COBALT ORES.

It is an acknowledged fact that the assay of nickel and cobalt is a most difficult and tedious operation, and with a view of discovering some simpler method than that ordinarily in use, Mr. C. H. AARON has been conducting a series of experiments. Although he is not prepared to say that he has quite succeeded yet, he anticipates being able shortly to announce an entirely new method accurate enough for many purposes, and much more rapid and convenient than other processes. The following is an abstract of some facts which have come to the knowledge of the experimentalist, and which in the meantime he has contributed to the San Francisco Mining and Scientific Press:—

Supposing the ore to contain, besides nickel or cobalt, or both of these, Fe., Mn., Cu., Ag., Bi., Pb., Sn., As., S., Sb., Te., Ca., Al., Mg., Ba., Sr., Si., or some of them. Dissolve in nitro-hydrochloric acid; dry, take up, filter; add sodium acetate to the not too acid filtrate; boil, filter; add citrate acid, pass hydrogen sulphide, filter, and wash with the usual precautions. To filtrate add ammonium chloride, then ammonia, which will throw down a part of the nickel and cobalt, by virtue of the hydrogen sulphide present. Complete the precipitation by means of ammonium sulphide (colourless or yellow); warm, settle, filter, and wash with water containing ammonium sulphide. The precipitate on the filter consists of nickel and cobalt sulphides, the manganese and all but traces of the earth having passed off in the filtrate. Dissolve out the nickel sulphide by a cold solution of potassium cyanide, which leaves the cobalt sulphide undissolved.

To the solution of nickel, separated from the cobalt sulphide by filtration, add hydrochloric acid; filter and calcine the washed precipitated also the filter. Weigh, as nickel oxide containing 78.67 per cent. of nickel. Convert the cobalt sulphide to sulphate, the filter being burned and the ashes added, either by roasting or by treatment with strong nitric acid, adding in either case a little pure sulphuric acid at the last, and heating to dull redness, until no more fumes are given off, and the weight remains constant. The final heating is best done in a platinum crucible, which must be covered. The cobalt sulphate when cold should have a fine pink colour, and should be completely soluble in boiling water. If the colour of the cobalt sulphate is not satisfactory it may be redissolved in boiling water and a little hydrochloric acid, the solution filtered if necessary, sodium acetate added, and hydrogen sulphide passed. The cobalt sulphide thus precipitated, collected on a filter and well washed, must be again converted to sulphate. It contains 38.06 per cent. of metal.

Another method which is more accurate is to dissolve and treat with sodium acetate and boiling as before; then add acetic acid, pass hydrogen sulphide, correct the precipitate on a filter, redissolve it and the burned filter, add potassium citrate; again, pass hydrogen sulphide, collect the precipitation on a filter, redissolve it and the burned filter, add potassium citrate, again pass hydrogen sulphide, which leaves only nickel and cobalt in solution, without a trace of the earth or of silica. From this point proceed as before. In precipitating from the acetate solution with hydrogen sulphide, there should not be too much free acetic acid present. In precipitating from the citrate solution, or from the acetate with addition of citric acid, there must be a considerable quantity of free citric acid, or some cobalt and nickel will come down. It is best to nearly neutralise the original solution with ammonia, before boiling with sodium acetate, to remove iron, alumina, arsenic, and phosphorus. If the ore contains chromium the iron and alumina may be removed by cold digestion for several hours with barium carbonate, not omitting the addition of some ammonium chloride to prevent loss of nickel and cobalt. Afterward add sulphide of sodium, or potassium, acetate, &c., as before.

The little known facts on which these modifications are based are—That not only copper, lead, bismuth, &c., but also zinc is precipitated by hydrogen sulphide from the citrates or acetates in presence of free citric acid, while nickel and cobalt are not; that manganese is not precipitated by ammonia and ammonium sulphide in presence of an organic acid; that recently precipitated nickel sulphide is soluble in cold solution of potassium; cyanide, cobalt sulphide not. If great accuracy is required, the ashes of the burned filter must be allowed for in the final weighings of nickel oxide, and, in the case of cobalt sulphate, the ashes of a similar filter must be treated with sulphuric acid, dried, weighed, and the weight deducted.

GOVERNMENT RAILWAY PROJECTS IN NEW SOUTH WALES.

The frequent appearance of the Government of New South Wales as a borrower in the English money market is explained by its anxiety, as representing almost the whole body of colonists, to construct a complete network of railways, which shall aid in developing the wonderfully rich pastoral, agricultural, and mining resources of the colony. The scheme proposed by the Colonial Treasurer, Mr. Dibbs, embraces 16 railway extensions, besides four light railways, making a total of nearly 1500 miles. The cost of constructing these is estimated at over 13,000,000. Some idea of the character of these extensions is afforded by Mr. Dibbs's speech, according to which the Sydney Railway terminus at Redfern, corresponding with the old Great Western terminus at Paddington, or the old North-Western terminus at Nine Elms, is to be brought into the heart of the city, after the manner of the Metropolitan and North London lines, the length being about 1½ mile, and the estimated cost 450,000. Among the country railways proposed is a line from Grafton to the Tweed river, via Casino, Lismore, and the Brunswick, distance 165 miles, at a cost of 1,980,000. This railway will communicate with some of the richest districts of New South Wales, and bring their numerous products to the only outlet from that part of the country—that is, the Clarence river—and at no distant date the line will probably be carried south, working through some splendid districts, most of the waters of which are not navigable, but whose soil and climate will grow almost anything. These railways will make the Clarence river a large centre, and a tap for an immense trade. Another line is that from Muswellbrook to Cassilis, distance 70 miles, 700,000—a railway which will furnish the only great want of a country rich in agricultural products. Then follows a line from Targo to Braidwood, a distance of 31 miles, at a cost of 310,000, and another from Gundagai to Tumut, via Adelong, at a cost of 500,000, the distance being 33 miles. The high cost of the line is necessitated by an iron bridge across the Murrumbidgee. It is a part of the colony languishing for the want of means of getting its produce to market. "Some 18 months ago," said Mr. Dibbs, "I saw quantities of produce stored there, but considered useless and valueless, because of no payable means of conveying it to a market." The next line is from Kiama to Jervis Bay, distance 41 miles, and cost 804,000. Ultimately this line will probably be continued south, opening up the coast districts to Twofold Bay. Next comes a line from Goulburn to Crookwell, distance 25 miles, cost 259,500; then a short line from Gulgong to Burrowa, 18 miles, at a cost of 141,000. It is a branch line, and will be an important feeder to the main trunk railway. Then follows a railway from Wagga Wagga to Tumberumba, distance 68 miles, and cost of 710,000. Next is a short line of 12 miles, to connect Tentfield with the Queensland border. It will cost about 173,500, the last of the heavy lines being a railway from Bowral to Robertson, 15 miles, cost 126,000.

NEW METHOD OF UTILISING PHOSPHORISED SLAGS.

The slag is melted in a cupola, whereby a matter is obtained containing 20 to 25 per cent. of phosphorus, then mix with powdered anhydrous sodic sulphate, and heat to redness. Treat with water to recover sodic phosphate by crystallisation. The insoluble residue mix with sodic sulphate and charcoal, and heat. The sodic sulphate first becomes sodium sulphide, and then by double decomposition, sodium phosphate and protosulphide of iron and protosulphide of manganese are formed. The mass thus yields another crop of sodium phosphate crystals. The residue after roasting to destroy the sulphides, can be used as iron ore rich in manganese, and the sodic phosphates can be employed for artificial manure.

PROPOSED PENNSYLVANIA COLLIERY VENTILATION LAW.

The Mine Commission appointed by the last session of the Pennsylvania Legislature to revise the ventilation laws, and which has been in session during the summer, has concluded its regular labours at Shamokin; and, according to the New York Engineering and Mining Journal, the articles containing the provisions of the proposed new law are:—

ARTICLE XII.

Section 1.—The ventilation of a coal mine or colliery may be effected by any mechanical appliance, provided there is produced a constant and an adequate supply of pure air.

Section 2.—At the expiration of one year from and after the passage of this Act it shall not be lawful to use a furnace for the purpose of ventilating any anthracite coal mine or colliery wherein more than 10 persons are employed, and in no case shall a furnace be used where the mine generates explosive gases.

Section 3.—The minimum quantity of 250 cubic feet per minute for each and every person employed in said mine, and as much more as in the opinion of the Inspector the circumstance may require.

Section 4.—The ventilation currents shall be conducted and circulated to and along the face of each and every working place throughout the entire mine in sufficient quantities to dilute, render harmless, and sweep away smoke and noxious gases to such an extent that all working places, and travelling roads shall be in a fit state to work and travel therein.

Section 5.—All worked out or abandoned parts of the mine or colliery shall be kept free of dangerous bodies of explosive gases.

Section 6.—Every mine shall be divided into sections or panels. Each section or panel shall be provided with distinct and separate inlet and outlet air passages, separated by a natural barrier of coal or stone, except where cross-headings are necessary for the purpose of ventilation.

Section 7.—All air-passages shall be of sufficient area to allow the free passage of not less than 250 cubic feet of air per minute for all persons working therein, and in no case in mines generating explosive gases shall the velocity exceed 450 lineal feet per minute in any opening through which the air currents pass, except in the main inlet or outlet air-ways, or in mines, or parts of mines, where, in the opinion of the Inspector, a greater velocity would not in any manner endanger the lives of the workmen therein employed.

Section 8.—Not more than 75 persons shall be engaged at any one time in any of said sections and panels.

Section 9.—Each and every such section or panel shall be provided with a distinct and separate split of pure air.

Section 10.—All cross-cuts connecting the main inlet and other outlet air-passages of every section or panel, when it becomes necessary to close them permanently, shall be substantially closed with brick or other suitable building material laid up in mortar or cement, and of sufficient thickness and strength to resist the force or pressure likely to arise from explosions, but in no case shall said air stoppings be constructed or planked except for temporary purposes.

ARTICLE XIII.

Section 1.—All doors used in assisting or any way affecting the ventilation shall be so hung and adjusted that they will close of their own accord and cannot stand open.

Section 2.—All main doors shall have an attendant, whose constant duty shall be to open them to allow transportation or travel through them, and prevent them from standing open longer than is necessary for a person or cars to pass through.

Section 3.—All main doors shall be so placed that, when one door is open, another, which has the same effect upon the same current, shall be and remain closed, and thus prevent any temporary stoppage of the air current.

Section 4.—An extra main door shall be so placed and kept standing open so as to be out of reach of accident, and so fixed that it can be at once closed in the event of an accident to the doors in use.

Section 5.—The framework of such main doors shall be substantially secured in stone or brick, laid in mortar and cement, unless otherwise permitted in writing by the Inspector.

Section 6.—All permanent air-bridges shall be substantially built of such material and of such strength as the circumstances may require, subject to the approval of the Inspector.

ARTICLE XIV.

Section 1.—The quantities of air in circulation shall be ascertained with an anemometer. Such measurement shall be correctly made by the inside foreman or his assistant once every week at the inlet and outlet air-ways, also at or near the face of each gangway, and shall be entered in the colliery report book.

Section 2.—A copy of these air measurements shall be sent to the Inspector before the twelfth day of each month, together with a statement of the number of men employed in each panel or section.

Section 3.—Any party who shall neglect or fail to comply with the provisions of this section, or who shall knowingly make any false return in regard to air measurements, shall be guilty of an offence against this Act.

NEW PROCESS FOR TREATING COPPER PYRITES.

At Cobar, New South Wales, Mr. CLAUDE F. J. WAUTIN has recently started his blast furnaces and converter, for the purpose of treating the sulphites without the aid of other ores. The object Mr. Wautin has in view is to obtain a rapid and economical method of treating copper pyrites without the aid of other copper ores, and to assist the smelting of them (as is now the case in the greater parts of the metallurgical establishments) without having to submit the pyrites to previous calcination; to obtain a rich regulus or even rough copper therefrom, without the aid of extraneous fuel, or to reduce the use of such to a minimum, by taking advantage of the great amount of heat that can be generated by the rapid oxidation of the iron and sulphur contained in the pyrites. The process can be extended to silicious ores, as it is necessary in all cases to add an amount of silica to act as flux for the iron present in the pyrites. The plant at present consists of a low blast furnace, and what may be termed a modified form of Bessemer converter, with blowing machine, for producing necessary blast. The *modus operandi* of the process is as follows:—A given quantity of pyrites or other mixtures of ores that will yield regulus, say 20 to 40 per cent. copper, is smelted in the ordinary way in the blast furnace, and the regulus from the same is run as hot and as rapidly as possible through a shoot into the converter, the blast for some time having been turned on before the regulus is admitted. The result of the air being blown through the molten sulphite of copper and iron is that the sulphur is partly burnt into sulphurous acid gas, and partly volatilised, and the iron is burnt into the protoxide, and in that form combines with the silica added for the purpose, or contained in the ore, to form a slag, and in such condition can be removed. It is claimed that the reaction produced either a concentrated regulus of copper of high percentage, or even rough copper. Thus it will be observed that the sulphur and iron can be removed by one process, notwithstanding the fact that, under present methods of treating copper pyrites, these two elements in their removal form the greatest difficulty to deal with.

CAOUTCHOUC.—Attention has been drawn to the tree of Southern India, known to botanists as *Primeria glandulifera*, from which large supplies of caoutchouc can be drawn. The gum is obtained by breaking the boughs and drawing it out in filaments. If the new caoutchouc is at all equal to the old in insulating properties, it will form a timely discovery, as the demand for india-rubber coated wires has largely increased of late, and inventors have been trying to manufacture a substitute for gutta-percha.

ARTESIAN WELLS IN NEVADA.—A very deep test well is being sunk by the Central Pacific Railroad Company, at White Plains, Nevada, on the 40 miles desert. The only good supply of water for the desert is brought from the Truckee river, 35 miles west of the new wells, and is hauled in tank cars for the supply of engines, &c. The well is now down over 2100 ft., but no water has yet been found, except a strong stream of salt water at 38 ft. down, and a hot spring at 653 ft. The work of sinking is, however, being continued, with the hope of eventually striking a flow of water.

Registration of New Companies.

The following joint-stock companies have been duly registered:—

LYNDHURST GAS AND WATER COMPANY (Limited).—Capital 20,000*l.*, in shares of 10*l.* Formed to manufacture, sell, and supply gas in the town of Lyndhurst, in the county of Southampton, and to carry on the business of coal merchants, also to supply the town with water. The subscribers (who take one share each) are—Henry F. Kite, Queen Victoria-street; D. A. Thomas, Ovenden, Sevenoaks; R. Bolton, Devonshire Chambers; R. Brown, Benwell Grange, Newcastle; Edward H. Oswald, Gelding Hall, Notts; B. Nicholas, 23, Cornhill; and Joseph J. Lobbs, New Croxtive-road, West Dulwich.

COAL AND SALT SHIP LOADING COMPANY (Limited).—Capital 20,000*l.*, in shares of 1*l.* To acquire by purchase the patent rights of Adolphus R. Large in a certain invention entitled "A. R. Large's Patent Coal and Salt Loading Apparatus," and to carry on the business of loading coal, salt, ore, ice, &c., on board any steamer or ship. The subscribers (who take one share each) are—A. W. Rogers, Savoy Buildings; James Hosmer, 8, Langham-street; G. L. Herrick, Langham-street; Charles H. Adams, 76, Cheapside; W. S. Lee, 75, Lombard-street; Thomas Crawford, Church-lane, East Finchley; John White, 126, Peckham Rye.

NEW CHILE GOLD MINE COMPANY (Limited).—Capital 500,000*l.*, in shares of 1*l.* To acquire the mines, property, estate, assets, and effects of the Chile Gold Mining Company (Limited), or any other mines, on any tenure, in the State of Guayana, in the Republic of Venezuela, or in any other district in South America. The subscribers (who take one share each) are—Hugh Watt, 32, Queen Victoria-street; J. R. L'Amey, 107, Cromwell-road; N. J. Nevill, 45, Charles-street; Henry G. Slade, Bartholomew House; —Gamenay, 3, Upper Avenue-road; Leonard Welstead, 32, Queen Victoria-street; John B. Cox, 32, Queen Victoria-street.

NEW TELEPHONE COMPANY (Limited).—Capital 120,000*l.*, in shares of 5*l.* To acquire the rights in the several inventions for improvements in electrical apparatus for the transmission and reproduction of sound, and the several letters patent for Great Britain granted to Silvanus P. Thompson, or to S. P. Thompson and Philip Jolin jointly, and to construct and carry out same. The subscribers (who take one share each) are—Thorlow, Chesham-place, peer; Sudeley, 7, Buckingham Gate, peer; Daniel Cooper, 6, De Vere Gardens, baronet; J. Irving Courteney, Essex-court, Temple; T. Harley Jones, 15, Finsbury Circus, M.A.; John A. Seller, 78, Hatton Gardens; and Silvanus P. Thompson, University College, Bristol.

BROMLEY-BY-BOW INDIA-RUBBER AND GUTTA-PERCHA COMPANY (Limited).—Capital 75,000*l.*, in shares of 2*l.* To adopt and carry out an agreement, dated Oct. 30, 1884, made between Legh Hoskins Master, Grant, and Co., and Wm. J. Dring, as trustee for and on behalf of this company for the purchase of the goodwill of the business carried on by L. H. Master, of Phipps-street, Finsbury, and to carry on the same. The subscribers (who take one share each) are—H. Steele, College Hill; H. W. Howard, 98, Park-street, Camden Town; W. J. Dring, Harrogate-road; R. Cartwright, 34, Upper-street, Islington; R. George Chipperfield, Trinity-street, Southwark; A. G. Maerono, 291, Camberwell New-road; Charles Beresford Robins, 225, Great Dover street.

NEW MYSONE GOLD MINING COMPANY (Limited).—Capital 100,000*l.*, in shares of 1*l.* To purchase, or otherwise acquire, lands, estates, and properties in India, and to work gold mines, minerals, and mining rights in India, or elsewhere; also to improve and cultivate the said estates and properties acquired by the company. The subscribers (who take one share each) are—H. T. Campbell, Copthall Buildings; T. W. Martin, St. Swin's-lane; S. Brewell, 17, Old Broad-street; E. Schubert, Whitehall Club; J. Walton, Jamaica-road, Bermondsey; John MacCorrip, 17, Adams-street, Rotherhithe; C. E. Fearn, Rectory Lodge, Stoke Newington.

GRASSMOOR COMPANY (Limited).—Capital 200,000*l.*, in shares of 10*l.* To purchase all the collieries, properties, and effects of the partnership firm of Alfred Barnes, Esq., M.P., and Edmund W. Barnes, Esq., now carrying on the business of coalmasters, under the style of the Grassmoor Company, the company undertaking to pay and indemnify the vendors against all the debts, also to carry on the business of coalmasters, ironmasters, miners, smelters, &c. The subscribers (who take one share each) are—Alfred Barnes, Chesterfield; Edmund W. Barnes, Ashgate House, near Chesterfield; Arthur G. Barnes, Chesterfield; A. T. H. Barnes, Chesterfield; Ernest E. Barnes, Ashgate Lodge, Chesterfield; Alfred W. Barnes, Hurst House, Chesterfield; Geo. Leach, Hasland, Chesterfield.

LIGHT RAILWAY CONTRACT COMPANY (Limited).—Every member of the company undertakes to contribute to the assets of the company in the event of the same being wound up during the time he is a member, or within a year afterwards, for payment of the debts and liabilities of the company contracted before the time at which he ceases to be a member. To carry on any such business as is usually done by those who, under the authority of Acts of Parliament, are engaged in the construction of public works, &c. The subscribers are—Henry Salter, Clement's-lane; Henry Salter, jun., 27, Clement's-lane; Edward Salter, Clement's-lane; R. G. Backhouse, 27, Clement's-lane; Henry Robertson, 27, Clement's-lane; Joseph Williamson, 27, Clement's-lane; and Frances J. Skinner, 27, Clement's-lane.

BUILDING SECURITIES COMPANY (Limited).—Capital 500,000*l.*, in shares of 5*l.* The objects for which the company is established are the transacting every kind of business, and particularly purchasing and re-selling land, sublease, and building agreements, and re-selling the same, and entering into contracts for the erection of works of any kind. The subscribers (who take one share each) are—Samuel R. Patterson, 11, Queen Victoria-street; C. Baines, 48, Finsbury-circus; George Dillely, Streatham; G. E. Brook, Croydon; L. B. Burns, 49, Cannon-street; Henry G. Wright, Adelaide Buildings, London Bridge; George J. Millen, Iverson-road, Brondesbury.

HOME SANITARY AND ECONOMIC APPLIANCES COMPANY (Limited).—Capital 5000*l.*, in shares of 1*l.* Formed for the acquisition and working of patents in connection with heating apparatus and boilers, also sanitary and other engineering works. The subscribers (who take one share each) are—F. Pryce, Sheppey-place, Gravesend; E. Massey, 10, Draper's Gardens; Charles Waitman, Draper's Gardens; John W. Brown, Darnley-road, Gravesend; W. J. Whitton, 162, Lancaster-road, Notting Hill; J. S. Desmoir, Market Buildings, Mincing-lane; T. E. Baxter, South Grove, Peckham.

IRON MANUFACTURE IN WESTPHALIA.—A striking instance of the immense advantage which cheap labour gives continental iron manufacturers, as compared with those in England, is afforded by the rapid progress of Mr. F. Krupp's Works at Essen. It appears that in 1860 his factory at Essen employed 1764 hands; in 1870 the number of workmen had risen to 7084, and the present number is about 20,000. Including the wives and children of the employed, we have 65,381 souls depending for their subsistence on Krupp's Works, 20,000 of these inhabiting houses belonging to Herr Krupp. The whole establishment comprises altogether eight sections:—(1) the factories at Essen; (2) three coal mines at Essen and Bochum; (3) 547 iron mines in Germany; (4) several iron mines in the North of Spain, in the environs of Bilbao; (5) the blast furnaces; (6) a range at Meppen, 17 kilometres in length, for gunnery experiments; (7) other smaller ranges; (8) four steamers for marine transport. The number of blast-furnaces in use is 11, of other furnaces 1542. There are 439 steam boilers, 82 steam-hammers, and 450 steam-engines, of 185,000-horse power altogether. At Essen alone the works are fitted with 59 kilometres of rails, 28 locomotives, 883 wagons, 69 horses, 191 carts, 65 kilometres of telegraph lines, 35 stations, and 55 Morse apparatuses. At present the Krupp Works are engaged in manufacturing for the Italian Government a monster gun which will weigh 130,000 kilogrammes (say 130 tons), and for the transport of which two wagons have been constructed, each able to bear a weight of 75,000 kilogrammes.

NEW SOUTH WALES DIAMONDS.—Recently at Bingera—the colonial Kimberley—the Australian Diamond Mining Company have washed 379 loads, and have gained 920 diamonds, weighing 197½ carats.

TRADE OF THE TYNE AND WEAR.

Nov. 27.—There is little change in the state of the Coal and Coke Trades here. A fair demand exists for most kinds of coal and coke, but not sufficient to raise the value to any extent. There is still a good demand for best steam coal, and if the weather on the coast remains fine to allow steamers to keep their engagements the best collieries north of the Tyne will make a full week's work. A fair amount of steam tonnage has been fixed to load at Blyth and Amble, which improves the prospect. In Durham gas coalworks continue fairly employed, but there is no extreme pressure. The demand for house coal continues to improve slowly on the Tyne and Wear, but holders cannot realise higher prices at present. Bunker coal, smiths' coal, nuts, &c., continue in good demand. The coal and coke shipments at Tyne Dock for the week were 113,724 tons, a very fair average; and at the other shipping places on the Tyne and Wear, and the smaller ports they have also been good.

It is seldom that we have to notice any new sinkings for coal winning in this district at present, but the new shaft at the Eltringham Colliery noticed some time ago in this letter, is now approaching completion, and the Cannel coal seam is expected to be reached daily. There has not been a large quantity of coal worked at this place hitherto, but it is likely to be considerably increased when this seam is developed. At present a large quantity of fire-bricks, sanitary pipes, and other fire-clay goods, including fine glazed bricks, are turned out, the fire-clay seams here being exceptionally fine.

A meeting of the North-East Coast Institution of Engineers and Shipbuilders was held at Newcastle, on Thursday last, Mr. C. W. Hutchinson, Chairman of the Provisional Committee, presiding. A council of 15 members was elected and the following officers:—President, Mr. William Boyd, of Wallsend; Vice-presidents, Mr. W. H. White, of Messrs. Armstrong and Co.'s, Elswick Works; Mr. Wigham Richardson, Low Walker; Mr. F. C. Marshall, of Messrs. Hawthorn's Works; Mr. C. W. Hutchinson, of the Elswick Ordnance Works; Mr. Robert Thompson, Sunderland; Mr. Wm. Clark, engineer, Sunderland. Secretary, Mr. G. W. Spence, of Newcastle. The meeting considered the constitution of the society recommended by the provisional committee, the objects of which were the furtherance of ideas and information amongst its members, and to place on record its transactions. That this society will prove to be a most useful and influential one we have not the slightest doubt. The list of officers includes men of the highest mark in the profession of shipbuilding and engineering, and are without exception men of practical knowledge and scientific attainments. Valuable papers may, therefore, be expected.

There is at present a Polytechnic Exhibition at Blyth. Between 30 and 40 models of vessels are exhibited by the builders in this district, which show the best examples of shipbuilding in those rivers from the time of the Jumna, built at Jarrow 17 years ago, until now, and various improvements introduced during that period. There are also models showing the mode of shipping coals by spout at Blyth and other places. Those models show that of late years great improvements have been introduced, with a view of preventing, as far as possible, the breakage of the coal.

The Iron Trade continues to show favourable symptoms, a fair business continues to be done, and shipments are well maintained. The deliveries for the month promise to be large, nearly 60,000 tons up to Friday last. Heavy deliveries continue to be made for Scotland, which balances the falling off from the Upper Baltic. Prices are well kept up to 16s. 3d. for No. 3 iron for early delivery, and 36s. 6d. forward account next year. In the manufactured iron trade there has been little change. The return of Mr. Waterhouse has shown that increased business has been done in the two months ending October, as compared with the preceding two months. The price of manufactured iron, however, continues at a very low range, and makers cannot get any profits of consequence at present rates. The steel trade continues in a favourable condition, and some engineering orders have been received. The award in the iron trade cannot be expected under a week from the present time; when that question is settled some improvement in the general iron trade may be expected.

There are some indications that we may have a demand for pig-iron from America, and if this is realised both pig and finished iron must increase in value. The United States are to begin cruiser building, and the British Government will likely do the same. There is a better feeling in the shipbuilding trades on the Tyne and Wear. There has been an order placed for a large vessel on the Tyne this week, and it is hoped that more will follow. The low price of materials and wages, &c., must have a tendency to stimulate the demand. It is worthy of remark that only a short time ago there were 104 steamers laid up on the Tyne alone, which taken at 20,000*l.* each represented a capital of more than two millions, from which there was no return; but a large number of those vessels have been got to work, and the number laid up is being reduced weekly.

As is well-known the makers of steel rails have entered into a combination to force up the price of steel rails, but as a rule those combinations do not effect the intended purpose; it is evident that the demand for iron and steel in the markets of the world has been comparatively small of late, and no combination of producers can remedy the defect. In the first ten months of last year we exported 660,417 tons of rails, and in the ten months of this year we exported 472,777 tons, or little more than two-thirds of the quantity of last year. The declared value of the exports of iron and steel rails for the ten months of 1883 was 3,925,538*l.*, and for the same period this year it was 2,587,383*l.* It is clear that these expedients cannot control trade; it is controlled primarily by great laws of supply and demand. Recovery will only come when a number of great railways are being constructed abroad, and when the railway prospects at home improve. The North-Eastern traffic receipts, which are considered a good index of the general state of trade here, have improved a little, but they are still very far from being satisfactory.

THE NEW SOUTH WALES NATIONAL PARK.—The Government of New South Wales have reserved one of the finest and most picturesque portions of the colony for a national park. It is situated in the Illawarra district, and embraces an area of 36,000 acres, having a frontage of 7½ miles to the Pacific Ocean. The park generally may be described as high table land, from which, at numerous places, excellent and extensive views are obtained of the ocean, Port Hacking, Botany Bay, Sydney, Randwick, &c., with deep gorges, and rich flats covered with beautiful foliage, bordering running streams of the purest fresh water. The high table lands to some extent consist of comparatively barren stony heaths, and of fair to good land, the latter in areas suitable for formation of recreation, review, and encampment grounds, or of plantations of ornamental trees, &c., and readily accessible, situated at elevations of from 350 to about 900 ft. above high-water mark. The valley of the principal water courses, notably of Port Hacking River and Bola Creek, are to a large extent covered with rich foliage, including cabbage tree and banyan palms, tree ferns, Christmas, myrtle, and other handsome shrubs, numerous large well grown blackbutt, woollybutt, turpentine, and other noble forest timber trees, rising at the part southerly and south-easterly above the confluence of Bola Creek with Port Hacking River, to heights up to nearly 200 ft., and bordering and adjacent beautiful streams, having occasional long reaches of deep, shaded, pure, cool, fresh water. The park will be made easily accessible from Sydney by the Illawarra Railway, now in course of construction, which will traverse a considerable portion of what may be regarded as one of the finest public recreation grounds in the world.

HOLLOWAY'S PILLS.—When inclement weather checks to a considerable extent the action of the skin an alternative is required to compensate the body by means of other channels. Holloway's pills can be confidently recommended as the easiest, surest, and safest means of attaining this desirable end without weakening the most delicate or incommuting the most feeble. When from frequently recurring chills or the inhalation of impure air the blood becomes foul and the secretions vitiated these pills present a ready and efficient means of cleansing the former and correcting the latter. By this salutary proceeding disease is arrested at its outset, its pains and inconveniences averted, and the nervous structures saved from the depressing effects entailed upon them by an illness.

REPORT FROM DERBYSHIRE AND YORKSHIRE.

Nov. 27.—The mild weather which has prevailed during the month so far has told against the house coal trade, which is much quieter than is usual for the time of year. To some extent it has also affected prices, which are too low considering the state of things during the summer. Still, the business with the Metropolis from several of the leading Derbyshire collieries has been tolerably fair, all things considered; but the price charged to consumers does not agree quite harmoniously with the rate at which good coal can be purchased at the collieries. Steam coal has continued in moderate request, only the quantity sent to London not being large, whilst the charge made for it can scarcely be said to pay, and this, of course, is owing to the difficulty in disposing of it outside the local and railway requirements; but with the proposed line of railway from Kiverton Park to Chesterfield this would be entirely changed, for there would then be a pretty straight run to Hull. Gas coal has gone off in large quantities, this being about the busiest time of the year for it, but without benefiting the suppliers, seeing that the charges for it are the same in winter as in summer. Slack and smudge are in moderate request only, and low prices do not induce consumers from a distance to purchase, owing to the carriage rate to the Lancashire manufacturing districts in particular, for the route is circuitous as well as long; but the Dore and Chinley line when completed will make a great difference to a good many colliery owners who cannot compete with some of those in South Yorkshire who can send over the Manchester and Sheffield line direct to both Lancashire and Cheshire, and, of course, at a much less rate.

The depression which has prevailed in the Iron Trade for some considerable time past appears to have been less felt in Derbyshire than in almost any other iron making district. The production of pig has been well maintained, and that without making any material additions to stocks. A good deal of the output of the furnaces has found its way into both Staffordshire and Lancashire, whilst the local consumption does not appear to have declined. The large foundries have done fairly well in heavy castings, including most kinds of pipes as well as cylinders. The smaller establishments, engaged on light and ornamental work, have been but moderately employed. In rolled iron, business of late has looked better, and this appears likely to continue. In steel spades and shovels trade has kept up fairly, as it has also with respect to malleable ironwork, for which Dronfield has long been noted, and Derby is fast obtaining a high reputation.

Trade generally in Sheffield and the neighbourhood has continued to improve, and there is every appearance that there will be a tolerably busy time up to Christmas Eve, when the holidays commence, and continue for a week or more. Steelmakers, Bessemer and crucible, are turning out more than they did a short time since, the requirements on the part of rail makers and those engaged in the making of tyres, axles, and wheels, having increased, and the same is the case as regards cutlery and tool manufacturers.

The mills running on ordinary plates are still quiet, but there is every likelihood that the new year will see a change for the better in this department, and that the ship-yards will again resume something approaching their old activity. Armour-plate makers have still plenty to do, and it is expected that more Government orders will be placed with them before long. In hoop iron a good business has prevailed for months past, and this branch is still active, orders coming principally from abroad. The demand for table and other cutlery has improved of late, although not much is being done on American account, our own markets just now being amongst the best. Australia, Canada, and other distant countries have lately sent some good orders for sheep-shears, as well as various kinds of hardware. Scissor makers are kept fairly going despite the foreign competition they have to contend with, as are those also engaged in light and fancy goods suitable for presents and for travelling bags.

The strike at the colliery belonging to the Barrow Steel and Iron Company, near Barnsley, was brought to a close on Monday last, the men accepting the terms offered to them in the first instance. About 1000 men and boys were out, but many of them have found work at other places, and are not likely to go back to their old place, yet it is one of those collieries where the highest wages are paid, and where work, as a rule, is comparatively good, even in the dull season. A large quantity of coke is made at the place for the furnaces at Barrow, the colliery being one of the best equipped in the kingdom, the outlay in connection with it having, it is said, been close upon 250,000*l.* sterling.

The Coal Trade of South Yorkshire is in a tolerably healthy state, and the collieries are working very fairly. House coal is in rather moderate request for the time of year, but some of the collieries have done a steady business with London, and the South steam coal has also gone off well, more particularly to Hull for exportation; whilst a considerable tonnage has also been sent to the ironworks in North Lincolnshire, as well as to some in the Leeds district. A good deal of coke is now turned out in the district, and of such a quality as to compete with that made in Durham. A large quantity of it is sent not only into North Lincolnshire, but to some of the ironworks in Derbyshire as well. The prices range from 8s. to 9s. 6d. per ton.

REPORT FROM NORTH WALES, SALOP, AND CARDIGAN.

Nov. 27.—With the exception of one or two mines in Cardigan, the Roman Gravel seems to be the only lead mine in the whole district which is working at a profit. This is due to the strength of the Great Roman lode and the completeness of the machinery and management. After a brilliant course of over 30 years, the quarterly balance-sheet of the Minera Mines shows a loss on working. The collieries are all fully employed, and the industries connected with them are in active work. In the iron trade prices are still very low, but, to a slight extent, remunerative, and the works are fairly well supplied with orders.

The principal slate quarries are well employed, and it is not difficult to sell good slates. It is the quarries with inferior slate that suffer in only ordinary conditions of trade. The stone quarries are busier than they were a short time back, and there is considerable demand for lime for fluxing and chemical purposes. Altogether, apart from lead and copper mining, the mine and minor industries of the district are in a healthy condition.

MANCHESTER ASSOCIATION OF EMPLOYERS AND FOREMEN.—On Saturday last the members of the Association made a visit of inspection to the Rochdale-road gasworks of the Manchester Corporation, and in the evening Mr. JOHN WEST, C.E. late Chief Engineer to the Manchester Corporation, at the meeting held in the Technical School, read a paper "On the Manufacture and Distribution of Gas, with Special Reference to Modern Appliances and Machinery now Employed at Gasworks." The Rochdale-road Gasworks are amongst the largest in the kingdom, and they are the only large works in this country where mechanical has altogether superseded hand stopping, the two principal mechanical systems employed for charging and drawing the retorts being the Foulis and the West patent arrangements. These and the various other appliances and processes in operation at the works were fully described by Mr. West in his paper, and, in conclusion, he observed that the last triumph of gas lighting that he had had the pleasure of witnessing was Wigham's patent trifurc group flashing gaslight, which had been completed and lighted by the Commissioners of Irish Lights, at the New Island lighthouse, at the entrance to Belfast Lough. Only the previous week he had been struck with the penetrating power of this light, which had an illuminating power estimated as equal to 2,600,000 sperm candles, when passing Belfast Lough at a distance of several miles, and, in his opinion, it was the light of the future for large and important lighthouses. With regard to the various application of gas other than as a means of illumination—cooking, heating, and the motive power of engines—it would be more generally used if the public possessed a fuller knowledge of their several advantages. In the discussion which followed Mr. Chesters, of Manchester Corporation Gasworks, remarked that Manchester had been the first to introduce mechanical stoking successfully, and he thought it scarcely reflected credit on the Metropolis that hand labour was still employed in the production of a large proportion of the gas made at the London works.

IS THE AMOUNT OF GOLD IN CIRCULATION THROUGHOUT THE WORLD SUFFICIENT FOR THE REQUIREMENTS OF COMMERCE, AND CAN WE INCREASE THE SUPPLY?

BY GEORGE O'BRIEN.

Gold being the paramount metallic currency and general representative of values of all property its abundance or scarcity controls both national and individual prosperity, and the above serious propositions must shortly be well considered, as its insufficiency as the only standard medium is too apparent, and gradually enforcing return to the ancient barter system of a "hatchet for a pearl," causing by its exclusive sway the bankruptcy, and consequent repudiation, of various countries with whom we trade, and general depression in our own industries.

The alternations in the prosperity of nations with whom we trade are created not always by their positive poverty in material wealth or industry, but from their not possessing the necessary and universal token gold, and many countries which formerly yielded the greatest amount of the precious metal are now completely denuded of it, impoverished by commercial transactions from depreciation of values of native products, and have reverted to silver currency amongst themselves, having only local circulation, and as we are not always in immediate want of their staple commodities and raw produce which we receive in payment for our manufactured articles, or *vice versa*, both are then suddenly thrown upon an irregular and overstocked market at depreciated rates. Thus they with their monetary system destroyed from impecuniosity derange all manufacturing communities. But, on the whole, those favoured centres of commerce which by free import and consolidated capital are ready with coin to purchase the raw material, imported produce of nations with whom they trade at very low rates, and manufacture them into articles of enhanced value: these of course recoup their advances with interest, and by the difference of values constantly inflate their abundant stock of gold. Thus the bullion of the world is in their possession by this decisive absorption, but having passed the point of equilibrium they cripple and destroy the purchasing and vital power of their customers, rendering some more procurable and abundant medium of reciprocity an immediate necessity.

The present monetary system may for a time be prolonged; but an inevitable result can be conceived, and the now favoured centres of commerce will find themselves in the position of the fortunate gambler, who having raked in all the money of his companions remains the only capitalist, and has to discontinue further dealings with them as profitless, unless to protect them for further aggrandisement, or to procure payment of amounts still unsettled, and remain a burden to him hereafter. And of this nature we in particular have examples in all our own connections which will cost us dearly, remaining nevertheless as proofs of our superior tactics in combination with capital and industry.

But let us carefully and keenly survey our prospects of future supply of gold, as exhaustion, climatic difficulties, extinction of inferior populations, and other causes render its sufficient increase an impossibility, and the current year will not yield 14,000,000 sterling value collected throughout the world, and which may be considered as above the future average. By reason of its colour, brightness, and location, closely beneath the earth's surface in alluvial positions, it was probably the first metal that mankind came in contact with, and, therefore, the most abundant and manifest demonstrations were discovered and ransacked before our time by the antecedent inhabitants of the earth.

It is found in most countries of the world, and generally dispersed over large areas, lodged temporarily on the bosoms or sides of hills, and deposited there in alluvials, being the clayey residuum of disintegrated mountains, dissolved by the action of the elements since the creation of the world, and which mountains once existed miles higher than they at present are, and in close proximity to their alluvial remnants.

These, again, are gradually disintegrated by water, and the clean gold left behind or carried off with debris into the rivers, and deposited in its channels by its superior specific gravity, mingled with sand and silt at lower levels. Such, then, are alluvial deposits, and from such sources mostly has our stock of gold been derived, and chiefly by the manual labour of slaves, in Asia, Africa, and America, being the accumulations of all past ages. Also from another but very limited source we have increased our store, by deep mining and extraction from lodes or fissure veins, and those of gold without much alloy exist in altitudes of not more than 2000 ft. above the sea level, and downwards to the coasts, being formations and infiltrations from the disintegrated altitudes in union with silica, and carried there by floods in contact with such matrix from its original birthplace—the lofty mountains, where it was once more sparsely disseminated, and by the gradual removal of altitudes we enjoy the levelled plains and prairies which we cultivate for our existence, and which also frequently contain gold in minute quantities. Gold is likewise found in alloy with silver, in lodes or veins, and generally in the proportion of 65 per cent. value in silver and 35 per cent. value in gold, in Mexico and the border States ceded to the United States of North America.

But gold lodes being a liquiscent cementation from the mountains disintegrated by the action of air and water in past ages and washed downwards, therefore their relative height above the level of the sea depends upon the width of the continent in which they are situated, having also relation to the original height of the mountain from which their matrix was derived, and the volume of the torrents of water which effected their removal, and which water has consequently ceased or decreased with the diminution of the altitudes and former cappings of snow.

Our own latest adventures in pursuit of gold have been made in India on exhausted alluvials, formerly worked by tyrant rajahs, who ruled India in detail before the advent of the East India Company, and who compelled their unfortunate slaves to work for a small pittance of rice or raggie, and on a deficiency in quantity of gold to be delivered up subjected them to torture, often crippling them for life, as a warning to stimulate their fellow slaves. The alluvial deposits in the Wynaad, Madras, and other districts in India, and on which above 3,000,000 sterling have been fruitlessly spent in pursuit of gold, are located between 3000 and 4000 ft. above the sea level, and extending downwards to the sea coast of Calicut.

But these late operations on supposed lodes were merely on superficial mantles following down the sides of hills (not dipping into them), and whose bosoms and feet were loaded with alluvials disintegrated from the mountains, and the fictitiousness of these lodes was so apparent that alluvials frequently existed both over and under them, and beneath the underlie of one in particular—the Perseverance—as much as 70 ft. thickness of clay reposed, being the primary disintegration from the mountains, and deposited there before the mantle of silica was formed, and 200 tons of this clay yielded only 2 grains of gold per ton. All these alluvials extend over a surface of more than 40 miles in length, and are perforated with hundreds of perpendicular shafts, circular in form, and without timber, and located in many places only a few feet apart, through the tenacious clayey deposition to a depth of 40 ft. and more, and were dug by Indian miners not two centuries ago in search of deposits of concentrated gold, found in such diggings on the bed-rock beneath, and as each head slave worked independently of his fellow-slave thus the contiguity of such shafts in the Wynaad, as elsewhere in alluvials, can be accounted for by the eagerness of the slave to deliver his quantum of gold, from fear of punishment, locating a new sinking as near as possible to the one of his successful neighbour who had fallen upon a "pot or find," and in Peru, as in California, as much as 10,000 ft. value in gold has been found within the space of a few square yards. Deeper trial shafts are also found isolated and in perfect condition throughout the Wynaad, extending in circuitous directions, following the windings of the hills, and sunk in the alluvials; and one I found beyond 70 ft. deep, dug by the Indians to test the ground for gold, and miles of shallow alluvials in different directions have been systematically turned over by mulattos and ransacked of their contents, yielding probably millions of pounds sterling to their former masters, as from virgin patches

which escaped their operations as much as 8½ dwts. per ton can still be found, and may be taken as an exhibit of the former richness of these deposits.

China and Japan produce together only about 750,000 lb. per annum, and, therefore, it is presumable that they have not much alluvials in reserve, as they are ancient and populous nations, very expert in gold finding and washing, and, in all probability, have thoroughly examined and exhausted their countries of it. The Chinese, in particular, are very expert, and travel to the world's end in search of it, following, like vultures, the retreating footsteps of the Californians and Australians from their abandoned alluvials, extracting from their refuse sufficient gold to pay them a daily wage; and they will always be found wherever gold is discovered, and may, therefore, be counted upon as its future producers; and, from having fewer wants and more patience than Europeans, will probably continue its pursuit, with their redundant population, seeking outlet to other countries.

The Russian Empire may be viewed as comparable to China as regards alluvials and yield of gold from all sources. Its extraction was reserved as a monopoly by the Government; but, as the yield was so scanty, former dispositions were abandoned, and, in particular, the Ukas of 1812, and a further concession in 1819 to smelters and mineowners, removed many doubts about the possible yield. But a further extension of privileges to private citizens has entirely dissipated future hopes of increase, as the results are miserable. At first, the usual enthusiasm induced by the magic word gold was exhibited by mining adventurers. Discoveries were made, companies formed, machinery invented; but purchased experience has sobered their imaginations respecting its illusions and taught them that in Russia, as in most places, that the industry belongs, as of old, to the hardy poor who may casually and deservedly meet with the coveted prize in a rich concentration or deposit. And by reviewing the statistical accounts of its yield in the whole Empire, we note the recorded and gradual decrease, and which depended upon the yield of private companies working on alluvials at a loss. This decrease was at first charged to pluvial variations, producing either droughts or excessive rainfall, and consequent overflow of rivers preventing operations; so that, finally, these repeated molestations brought work to a standstill. But the real fact was deducible from their own reports; and thus we find that the supposed rich washings are utterly exhausted, causing the abandonment of whole districts and complete failure of the adventurers. A temporary climax had been reached by chance discoveries of concentrations always found in alluvials. The total yield of Russia in 1877 was 2502 puds of impure gold (worth, net, 661,500 lb. sterling) from the washings in the Ural, with West and East Siberia, and of this amount three-fourths of the whole output was derived from Eastern Siberia, and its yield governs the increase or decrease of the Empire, and which, since 1877, has considerably declined.

A large field for gold is probably Africa; but we must not, as in India, draw upon our imagination, without reflecting that inferior populations are best adapted for such operations requiring endurance for the climate, and which only the negro is fitted for, and we also remember that it has been more thickly inhabited, and, therefore, has in all probability been tracked over and ransacked of its richest contents, and which were only derived from alluvials. It has yielded from the year 1492 to 1883 about 107,000,000 lb., and still yields about 1,300,000 lb. per annum from all its native populations. But adventures have lately been made there by deep mining on lodes, but the samples indicate alluvial formation being granulated quartz studded with specks of gold.

The South American continent was famous for gold, and in the Republic of Chili many hundreds of abandoned gold mines are still open for inspection formerly worked during the rule of the Spaniards, having a depth of 200 ft. to as many yards, and the most extensive districts were Villa Rica and Talca in the south, and Talca, Andacollo, and the desert of Atacama in the north, with also many other districts now without resource of water, and can only be worked in rainy seasons. This Republic still yields a few thousand pounds sterling annually; but mining there on lodes is not now followed, as this source of yield is too precarious for mining experts like the Chilians, taught by past experiences, being very skilful, as the whole nation follow mining as a speciality.

Peru formerly produced enormously in gold from alluvials and dried up beds of rivers deviated from their courses by the Incas, and memorials of their gigantic operations remain to us for inspection and instruction. Their "hill diggings" are studded with innumerable perpendicular shafts, and as in the Wynaad, India, contiguous to each other. But their depositions have been much ransacked, and lie chiefly between the sea and coast ranges of the Andes ranging from south to north, and falling into the River Amazon, and whose pestiferous valleys guard for future explorations the remnant alluvials. The accumulated gold of the Incas transferred to their Spanish conquerors sensibly increased the money circulation of the world; but the waste of human life since the conquest of Peru by Spain in mineral operations has been enormous, as it then contained from 30,000,000 to 40,000,000 of inhabitants, reduced at the present time to about 6,000,000, and these facts enable us to estimate the toils and costs incurred in pursuit of the precious metals, and no other nation probably has been more cursed by its presence. But no accurate archives have come to light to exhibit its approximate yield, excepting the partial statistics of one department in Upper Peru, now Bolivia, showing a yield under Spain of 41,000,000 lb. in 185 years. It was also famous for its silver mines, as the Cerro del Pasco and Potosi still proclaim, but it is now the poorest nation on the earth in both gold and silver coin, although the circular silver bill of Pasco has not yet been exhausted after 300 years of extraction, but Peru has been a land for adventurers who have left nothing behind them. Allured by the supposed omnipotence of gold and silver, Spain revelled for the time in luxury and conquest. Thus, it has brought no established gain or endurable prosperity to countries which have yet possessed it, being only a fleeting alluring security, unless wisely regulated requiring now some other medium to assist it and promote more universal principles of reciprocity, and Spain rich in all else, is itself now completely denuded of it. The natives of Peru, drawn from the more permanent wealth to be contributed by the cultivation of their magnificent country as it existed in the time of the Incas, were driven from such employment to produce the precious metals, and they revealed to the Spaniards the localities for silver indicated, and in its extraction chiefly the loss of their population was incurred, showing that to acquire even this metal, time, skill, and capital are required, and that is not so easily procured as is generally supposed.

The silver mineral district of Potosi is situated in the Andes, between 12,000 and 13,000 ft. above the sea level, and a city containing 20,000 inhabitants was built there for their new masters, as also the marvellous reservoirs constructed to supply them with water, and also the operatives at the mines, and the numerous animals required to carry the silver ores, stores of food, and mining materials, for five consecutive years. These reservoirs are supplied with water from the melting snow of the Andes, and without them no continued work could be carried on. They have been designated as the eighth "wonder of the world," and are constructed with great skill by building huge puddled dams across deep valleys miles in width and length, and located in succession one above the other, and at the time of their construction, 300 years ago, cost, using slave labour, more than \$5,000,000, and which would represent at the present day 5,000,000 lb. sterling. These imperishable memorials will for ever remain, as every year they are further strengthened by the gradual deposition of silt, which time cements into stone, and during a revolution in Potosi the late President of Bolivia Juan Melgarejo, desiring to reduce the city, drove a tunnel through the dam of the lower reservoir, and meeting with the petrified silt, used a large charge of gunpowder, which failed to injure it, and forced him to abandon the work of destruction, which he had contemplated. These mines still produce small amounts of silver, but since the country has been released from Spain the population at Potosi has decreased, but by the previous destruction of their population they are unable to cultivate the soil as formerly, by using the canals which formerly intersected the whole country to the highest elevations, as the water required for the irrigation of their homesteads had been purposefully deviated by cutting off the supply at the sources to starve the

inhabitants into submission, and when in succession their attention was directed to their new riches—the nitrate and soda deposits on their coasts, they had not the individual power to work them, employing the Chinese coolie to operate on the guano, and the hardy native of Chile and capitalist, exploded the nitrate; and as sequel to such impotency these coveted territories have passed by war from their possession, by inherent feebleness and exhaustion caused by long ages of slavery in mining operations.

I have endeavoured to show the cost incurred to procure both gold and silver, and that the presence race of Peruvians have not the numerical strength, or desire to pursue such adventures any longer, and that it can only be continued by alien races, probably the Chinese, and these immigrants subject to the penalties, and more than ordinary destruction of life suffered in like operations, in consequence of tropical heats, and the very malarious climate of the lower interior country between the inner and outer ranges of the Andes. The country has many railroads not all likely to be useful to the present generation, but two remarkable ones deserve mention.

The one, the Aroyo, from Lima to a summit pass, leading to the head waters of the River Amazon to connect the inner provinces with Brazil, to a height of 15,000 ft. above sea level, but it is not in running order to the summit indicated. The other is finished, and in running condition from the Port of Mollendo in the Pacific Ocean to Lake Titicaca, of fresh water, the lake being about 160 miles long, and from 20 to 50 miles wide, and situated about 10,000 feet above the sea level, and is dotted with islands once in cultivation, the neighbouring country being extensive tablelands worthy of a numerous and vigorous race, and who will, at no distant period, repopulate these regions. The River Puro or Azar, running into the Amazon, forms a boundary line between Peru, Bolivia, and Brazil. The neighbouring Empire of Brazil, bordering on Bolivia and Peru, is at the present time almost unexplored, being covered with forests, and peopled by unsubdued Indians. Brazil has yielded gold to the value of 150,000,000 lb. from the year 1691 to 1884, and mostly from alluvials, but at present contributes only about 240,000 lb. per annum, and the extinction of slavery will not alter this amount, as the native Indian races are chiefly independent tribes, and under self-control, and therefore, although the interior has not been so completely ransacked as other countries mentioned, but the disintegration of the Andes is very rapid on the eastern slope from heavy rainfall and sharp alternations from cold to heat, and the water system so ramified and perfect down the innumerable streams as to make it difficult to find concentrated gold as in the dried up beds of rivers elsewhere. The altitude of the Andes has diminished 17 ft. since the time of Humboldt, and the vast amount of debris thus thrown off has been deposited on the plains or pampas, covering up the disseminated gold, and thus whilst this activity continues the alluvial deposits will be too mixed and poor to pay for working. Deep mining on gold lodes in Brazil has been very productive in past epochs, yielding fortunes to individuals, but not largely increasing general circulation. The mines are situated as elsewhere, beneath the altitude of alluvials, in form of reefs, confirming in a measure the secret of their origination by liquiscent removal and dislodgement of substances in society with gold. And geological teachings show that gold exists in the oldest known rocks, and not in limestone formations, and has been redistributed through all removals, and also that in the metamorphosis of these derived rocks it has been concentrated into segregated veins by liquiscent agency in society with fluid silica, salts of iron, and other mineral salts, and cemented together by their action, and that it is a constituency of most earths, and is found in fissure veins of all ages.

COPPER MINING IN NEW SOUTH WALES.—In Cobar, New South Wales possesses another and richer Cornwall, but mining operations are much retarded by the absence of railway communication in the district. In consequence of this the mining company is compelled to use wood instead of coal as fuel, and to procure this a tramline has been specially constructed, the terminus being now 11 miles from the mine. Each locomotive makes four trips per day, or about 140 miles, and brings in from 10 to 15 tons of wood each trip. During the half-year ending June 30, 1884, no less than 81,000 tons of wood were brought in by trains and 4000 tons by drays, making a total of 85,000 tons. When railway communication exists coal alone will be used. During the half-year ending June 30, 1884, the quantity of ore raised was 12,022 tons; ore smelted, 11,876 tons; fine copper, 1375 tons; fine copper dispatched, 1740 tons. The cost of the tramway and machinery in connection with the mine is estimated at 30,000 lb.: 14 furnaces are at work; two are under repair, and two are under construction. A stack of bricks has been erected 150 ft. in height, 18 ft. square at the base and 10 ft. at the top, with a brick flue about 200 ft. long, 9 ft. high, and 8 ft. wide, which is to be connected with the calciners, roasters, and refining furnaces. The company have excavated 15,000 yards near the mine, and have a reservoir, the embankment of which is 1243 ft. in length, 30 ft. high, and 123 ft. in width at the bottom, and 43 ft. at the top, in addition to which 43,000 yards have been excavated, securing a watershed of about 26,000,000 gallons. The water in this reservoir was the mainstay of the water supply during the last severe drought for the inhabitants of Cobar. The total number of men employed at and in connection with the mine is 907. This is inclusive of 40 boys, but exclusive of teamsters taking copper to the railway station.

SALT ON THE PACIFIC COAST.—In the reduction of silver ores and other metallurgical operations on the Pacific coast of North America between 20,000 and 30,000 tons of salt are disposed of every year, besides which a vast quantity is used for meat and fish packing and such like purposes. It is, therefore, fortunate that of all the useful minerals found on this coast none are so widely distributed as salt. Besides numerous salt springs, ponds, and lakes, this mineral exists in crystallised layers interstratified with other substances, the whole forming great mountain-like masses, and in deposits occupying the beds of dry or nearly dry lakes, on wide, extended marshes, alkali flats, &c. Large quantities of salt are also manufactured by solar evaporation, the long rainless summer being specially advantageous for the operation. On the Bay of San Francisco alone 50,000,000 tons are produced in this way every year. The plan of producing salt by boiling in kettles or evaporating the brine by artificial heat is not practised here. In the vicinity of Alvarado the evaporating reservoirs cover hundreds of acres.

LOSSES IN SMELTING.—In roasting as well as smelting lead ores there are certain losses which cannot be avoided entirely, but which may be reduced to a minimum. In roasting an ore it first experiences a loss in weight owing to chemical reaction taking place: it loses water and carbonic acid, sulphides of metals are converted into oxides, and thereby decrease in weight. If the roasted ore will then show more silver by assay than the crude ore, this would prove that no loss of silver had taken place. If roasting is carefully conducted the loss of silver by volatilisation should not be over 3 per cent.; but anti-mony, arsenic, and zinc causes a much higher loss by carrying off silver along with them to an extent which, if the temperature has been too high, may approach 20 per cent. The losses in smelting are caused by the formation of speiss, matte, and other byproducts which are thrown away. Slag will also cause a slight loss in metals, even if of normal composition. Zinc blende will increase the loss in the slag materially. The loss by volatilisation is very slight so far as the silver is concerned, and may be entirely avoided by having enough lead in the charge to cover the silver. It is, however, not known what exact minimal quantity of lead is required to cover a certain quantity of silver and prevent loss. Smelting in Leadville is said by Mr. Hahn to have proved the fallacy of Kert's statement that 300 times the amount of lead is required to cover one unit of silver. The volatilisation of lead is very large when charges low in lead are smelted as in Leadville, where frequently charges containing only 7 per cent. lead are treated. The loss of silver at Leadville is between 3 and 4 per cent., while the loss of lead from all sources amounts to from 13 to 15 per cent. At the Horn Silver Works, in Utah, the loss of lead is stated at 8.71 per cent., but there they treat charges richer in lead.

FRESH DISCOVERIES OF SILVER ORE continue to be made in New South Wales.

DESCRIPTION OF A NEW RULE FOR TESTING FANS.—No. III.

BY PROF. A. S. HERSCHEL, M.A., F.R.S.

Speaking only of open running fans which are generally single power, but of which Mr. Capell's fan yet presents a double power example, the channel by which air courses through them when running either sparsely or plentifully full, is, I believe, always and in all of them of such a naturally expanding *evase* description within the fan's chambers and passages that the rule of plane layers always holds good to a practically sensible and complete extent in the air's motion of entrance into and passage through the fan. But in the air's discharge from the circumference the rule of motion in plane layers ceases unless a properly *evase* covering is given by which the velocity of departure from the blades is turned into water gauge before the air is delivered into the outer atmosphere. The covering of blast fans may be regarded also as roughly securing the condition of the air's motion in plane layers after leaving the fan blades, and a naturally expanding and contracting air-way may be supposed to extend in chimney cased fans and in blast fans, from the fans central inlet to the mouth either of the *evase* chimney or the more or less contracted tuyeres through which the air is blown. No grasp of the air exists beyond the point where it enters the atmosphere, and any velocity which it has there, and at other points along its course where expanding air-ways lose their hold or grasp of the air in the same way, consumes driving power because velocity of this description is unable to convert itself by help of the channel expansions into head or water gauge of onward pressure. At some other points, however, along the air's course, and especially I suppose at the inlet of the fan and its blade passages, channel expansions present themselves which preserve their hold upon the air as its stream through them widens, and in these the head used to force the air through the previous contraction is more or less regenerated, or reproduced and made available again to furnish onward current against friction and other contractions lying further on.

If the water gauge were taken (compared to the outer atmosphere) at a point where an air draught emerges freely into a large chamber of a mine, and there loses its way and disperses its velocity, the product of this water gauge and the volume of air entering the chamber will be a true measure of the work done by the air from the outer atmosphere up to this point. But if by channel expansion the air flows in a gradually widening stream into the chamber its velocity of entry will be partly reconverted into pressure capable of forcing on the current through the chamber and into an outlet gallery towards the upcast of the mine. The work done up to the chamber entrance is fallacious as part of the whole ventilating work done in the mine, because it partially regenerates itself, and may do so in a very large and spacious chamber to the whole amount of the head or water gauge due to the velocity with which the air enters the spreading passage of the great sousterrain, or roomy space. If, however, the air still preserves some velocity of flow in the widest part of the chamber, then the difference between the heads due to the velocity of entrance, and to the velocity left in the air where its stream is widest, is a fictitious part of the water gauge observed at the draught entrance, and the work for that water gauge from the outer air to the entrance is fictitious in part to that extent as respects the whole balance of work used to ventilate the mine. If other sousterrains further on along the course are taken in succession until we come to the fan itself, whose radial cells form just such a gradually expanding chamber, the same rule as before will hold for each chamber by itself, and at last it appears to me also for the revolving fan as a final expanding chamber of the course. The water gauge, compared to the outer air observed at the fan entrance, will be fictitious as respects the balance of work done up to the end of the circuit, here—or in other words, used to drive the fan—to the extent of the difference of heads due to the velocities respectively of the air's entrance into the fan, and its discharge from the fan blades, or fan mouth, into the free vault of the outer atmosphere where the air loses its way and disperses any velocity with which it is discharged before it again enters the downcast shaft of the mine, or the inlet of the fan, and begins its course again.

In Mr. Capell's fan, which draws air in a very rapid stream through the inlet and discharges it at the circumference of the fan with only 1-6th or 1-7th part of the velocity of entrance at most when running full, the allowance in inches of water gauge to be made for fictitious or self-recovered head of velocity is practically coincident with what belongs to the velocity of entrance, the deduction for the issuing velocity being only about 1-40th part of the head due to the speed of entry, and with the approximate formula to compute it—

$$\left(\frac{V \text{ ft. per minute}}{4000} \right)^2$$

the observed inlet water gauge in trials of the double power fans corrected by this abatement yield really working or effective water gauges whose product when multiplied by the air volumes passed per minute show no anomalous excess of the work in the air above the work used to drive the fan, but measures of power which are pretty evidently by their consistency and accordance with each other fairly correct indications of the fan's efficiency in those conditions.

The rule of deducting water gauge due to inlet speed less that due to outlet speed, from the observed exhausting or blowing water gauge is probably a genuine one for obtaining the working or effective water gauge, in all close or open rotary fans, but in the colossal ones used for ventilating mines the low speed at which the air courses through them renders the allowance of inefficient water gauge for the velocity of entrance practically insignificant, and the need of using it has for this reason been hitherto commonly overlooked.

It is not so, however, with the blade tip speed of whirling velocity with which open fans of many types project the air at its exit into the atmosphere, the water gauge due to which is theoretically equal to that which they raise in vacuum, and must by the rule of correction for air speed at outlet be added to the observed water gauge at inlet as consuming instead of relieving driving work. The peculiarity of Mr. Capell's fan seems to be that without any outer casing it succeeds in delivering the air at its circumference without the whirling speed of the blade tips, with which other open running fans trouble it off; and as its mode of action is self-contained in the fan the air propulsion can be carried on without waste of power at the highest speeds which the fans have yet been made to endure. The above description explains and proves, I believe, correctly (although the subject is from some points of view a difficult one) the allowance for ineffective water gauge which must be made in cases of such unusually high speeds of motion given in air currents, as occur in the rapidly driven fans of Mr. Capell's types.

Subsequently, Prof. Herschel wrote, in continuation of the same subject:—The case of blast fans blowing through tuyeres into the open air (or the hearth of a furnace), and of fans working in any outer covering, the outlet of which is not purposely made trumpet-shaped to discharge the air without sensible velocity from the fan's confines, is so entirely different as regards the application of my water gauge correction rule, by reason (as I described in my letter of the day before yesterday) of the water gauge due to the outlet velocity in this case having to be deducted from the correction of water gauge due to inlet velocity from the ordinary case of exhaust fans made like Mr. Capell's to deliver the air without any appreciable outlet velocity from the fan, and the case again of uncovered fans like Waddells, Rammels, and other similar fans in which whirling velocity exists to a large amount in the outflowing air is so perfectly provided for by the amendment in my letter of the first imperfect rule applying only to Mr. Capell's exhaust fan, and to two examples of its action which I sent to you some time before (in my letter in July from Bangor), where it had a form and was used for examples entirely lacking the generality of which such a rule ought to have (and which it is due to its theoretical importance, if possible, not to cramp and deprive it of), that I meant to have asked you in my note of answer two days ago to your very suggestive queries to please not let my former letter about the fictitious water gauge correction appear in a published form, if possible, as you proposed presenting some of it to the Institute of Mining Engineers, at Dudley, without the complete statement and full proof and explanation of the rules, proper application, and mode of use in all cases of revolving fans, which I

just now sent you, being added to supplement, and to rectify and complete it as a postscript. I write to ask your kind consent to this course, if it could conveniently be followed, as the inadvertence of not adding to the free concession to publish what you please of my former letter, but I hope that you will, if possible, add this letter to it as a postscript, would cause me very much regret if the first imperfection of the rule (which was only casual, and does not really belong to it) should from obvious insufficiency which it involved to meet the conditions of performance of by far the greater proportion of ventilating fans having large air-speeds at their outlets, lead either to the rule's rejection as a fallacy by practical overseers of mine ventilation, or else to its incurring from them such critical castigations for its defects as I could not at least profitably for the matter's useful discussion in its present state of quite inadequate exploration by theory and experiment show the rule's real exemption from with anything like the plain brevity and cogency with which I found it very fortunately possible to elicit and prove a strictly rigid form which it has for all cases in the letter which I just lately wrote you. The suspicion of the rule, which I entertained and tested in my first letter, confirms itself so completely when its mode of use is examined as you suggested at different points along the air-way of a mine by leading directly when this way of interrogating the point is used to the simple consequence that it is only in the fan's chamber (between its inlet and its outlet) where the whole driving work of the course or air-circuit is done and generated, that the allowance for air speed (entering operatively and going out inoperatively) has to be taken account of, and made use of as a water gauge correction that this easy rectification of the ordinary method of reckoning horse power in air by water gauge and volume will, I hope, be understood and resorted to hereafter; and hoping that you may be able by my short explanations to make it practically intelligible and generally comprehensible in some measure to the South Staffordshire and East Worcestershire Mining Engineers.

PURIFICATION OF PRECIOUS METALS IN THE CRUCIBLE.

An important and interesting paper on the toughening of gold in the crucible was read at a recent meeting of the American Chemical Society, by Mr. J. C. BOOTH, Ph.D., melting refiner, U.S. Mint. In all operations in the arts, economy, especially the avoidance of needless wastage, is, he remarks, of importance in direct proportion to the value of the material operated on. While a loss of 10 per cent. may be and is tolerated in working iron in the fire the United States Government holds the officers of the Mint responsible in working gold, for any wastage beyond .001 (1-10th of 1-per cent.), and in silver beyond .0015. In practice the actual loss is usually far within that range. In general the tolerance of loss in working the metals is inversely as their commercial value.

The recent progress of knowledge and skill in the arts is well shown in the improved commercial character of some of the commoner metals. When he first examined the copper of commerce in 1850, with reference to its use for minor coinage, or for alloying gold and silver coin, he found that a large amount of the best commercial article contained about 98 per cent. copper, and that it often made hard or brittle alloys. They now employ copper averaging 99 per cent. pure, with small quantities of nickel, silver, oxygen, silica, and the usual intruder into everything on earth iron. In a few instances, 50,000 lbs. of extra refined copper yielded, to a specially fine analysis, about 99½ per cent. copper. In like manner a remarkable change has occurred in the silver market. About 1850 the best commercial silver usually assayed 99 per cent., and in 1853 he took credit in exhibiting a pile of about 10 tons of silver that averaged nearly 99½ per cent. At the present time a large amount of the good silver of commerce from the mining regions averages 99.9, and sometimes attains 99.95, failing only by 0.0005, of absolute purity.

The gold of commerce generally requires toughening or purifying to fit it for coinage or for jeweller's use, as it consists of bars, with silver, somewhat improved by melting, of lumps and grains of ore, and of old jewellery, containing tin, lead, zinc, and all the cheap elements that ingenuity, greed, and deception can use to dilute and cheapen the precious metal, without wholly obliterating its coveted yellow colour and its toughness. Some really tasteful jewellery, of fair quality to the eye that chooses to judge for itself, contains only one-fourth of gold, and some still less. The lumps and grains are melted to drive off mercury, &c., and are then refined, together with good silver bars, by acid processes termed quartation or parting. Where tin is present, as in jewellery, the nitric acid process is preferable, and after thoroughly washing out nitrates, muriatic acid, drenching the residue, dissolves out the tin, and the residue is pure gold. Iron is a frequent enemy to the ductility of gold, an extremely small percentage rendering it hard or brittle. The principle there developed is to remove all the embrittling elements, with the least practicable quantity of the valuable metal, on one side (to be subsequently purified); and on the other, to have all the rest of the gold practically pure. The loss of gold in the fire is in proportion to the length of exposure and to the quantity exposed; and the process described eminently guards these points. A single practical illustration will make the principle clear. Suppose a melt of 5000 ozs. of gold, containing .001 (5 ozs.) of embrittling impurity, are separated by a short working in the fire, into 100 ozs. skimmed off impurity (consisting of 95 ozs. of gold and 5 ozs. of embrittling matter, together with the flux) and 4900 ozs. of practically pure gold; then only 95 ozs. are exposed to further possible wastage in the fire.

The principles and to some extent the practice above applied to gold, may be applied to silver adulterated with lead, tin, zinc, &c. In spite of the great improvements in preparing silver bars for the market, as noted above, we often received them alloyed with lead, &c., and quite unfit for coinage some 10 or 15 years ago. Recently they have generally been unexceptionable. There was no reason for having inferior silver in the market, because the Western smelters then had cupels, and knew how to use them; but the lower price of the inferior silver was an irresistible temptation to a purchaser. He bore the brunt of the mistaken purchase, for the question given to me for the solution was to refine a few tons of plumbic silver, without a cupelling hearth, for even if he had desired one there was no room for its erection in the Mint. Since he solved the question successfully, and by a rather novel method, it seems to be worth describing. At one time he smelted a lot of some 50,000 ozs. of commercial silver bars, in melts of about 3500 ozs. each, and treated each melt in the same way, as follows:—It was melted, with the addition of about an ounce or more of anhydrous borax, which greatly facilitates fusion, and, to a limited extent, prevents volatilisation, although forming only a paper-thick covering to the melted metal. A covering of bone-ash (from ½ to 1 in. thick) having been sprinkled over the surface, crystals of soda-nitre are here and there dropped through the covering, and after effervescence has somewhat progressed a black-lead dipper, held in the tongs, is moved around the top, in interlacing circles, to spread the oxidation, and the metal is then more thoroughly mixed by plunging the dipper to the bottom of the metal, moving it up and down once or twice, and, after lifting it out full, by pouring it back into the metal. This operation of oxidising throughout is advantageously repeated, and more than once, if the silver is known to be foul with lead. All these operations being rapidly performed, the surface is hastily skimmed by a triangular crucible (so as to have always a flat side for skimming), experience guiding the melter to take off all the flux matter, with as little silver as it is conveniently practicable. The whole time of oxidation and skimming is of but a few minutes' duration, so that no chance is given to the oxidised metals to revert to the metallic condition in the presence of their tempers, carbon and melted metal. The processes of oxidising and skimming are repeated until the look of the remaining silver, or the test of a cast strip proves sufficient purity of metal. In the case here specially noted the working of 12 melts occupied between one and one and a half days to resolve them into over 49,000 ozs. of silver sufficiently pure and tough for coinage, and less than 1000 ozs. of silver with litharge and other oxides in the skimmings. These last consist of bone-ash, cemented by litharge, borax, and alkali into mixed soft and hard sponge or brick, with some grains of silver entangled in the mass.

The treatment of the skimmings constitutes the chief and, he believes, novel peculiarity of the process. The whole residues having been charged into pots, with the addition of some charcoal to aid in reducing the litharge, and of pearlash to make the slag thinner, was melted in a covered crucible at a full red heat, and allowed to cool quietly, so as to make a kind of all the reduced metal, with a cinder or slag above it. When cold the slag and cinders were ground and sifted to recover metallic grains. The cold kings were put into a crucible and gradually heated, by a long-continued heat, from below the melting point of lead, to a full red heat, and the eliquated metal, at different heats, collected separately. The first runs were nearly pure lead, so as to be cut with the same facility as the soft lead of commerce. There was only a slight wastage of silver in all the above operations, and but little loss of lead. He found the whole process a very short method of procuring nearly the whole of the silver from its obstinate alloy with lead, and attended with a trifling wastage; and he has good ground for believing that a little experimental practice might easily lead to its further improvement, so as to be substituted for cupelling, where the latter is not convenient. The depressed hearth of a reverberatory might readily be used as the blacklead crucible, and other modifications devised according to the exigencies of the case. These remarks are not designed to disparage the admirable process of cupellation, but merely to show that they are not necessarily confined to the last. In fact, the process he has indicated is cupellation, with a movable cupel, and oxy-salts used instead of a blast. It is hardly worth drawing the plain conclusion that where lead is thus removed from silver, zinc, tin, antimony, &c., will be oxidised at the same time, and caught either in the metallic residues (kings) or as oxides in the cinders. So efficient, economical, and easy of execution is the process that one leaps to the conclusion that where silver contains one or more of the above oxidisable metals, lead may be added and the whole worked off with ease. Direct trial has proven it.

The question having been propounded to him about a year ago by a worker in copper alloys of removing the phosphorus from phosphor-bronze, he applied the principle herein developed of using the greater oxidisability of the phosphorus and skimming it off, with a cover of lime on the melted metal. Although he had the time of but a half day to test the process, and in spite of no previous experience in skimming, he succeeded so far as to prove that a simple and effectual process can readily be evolved from the hints he has given in this paper.

FRESH DIAMOND DISCOVERIES IN NEW SOUTH WALES.—The reported discovery of diamonds near Mittagong, some years ago, recently induced two men to try their luck in the creek where the stones were supposed to have been found, and they recently succeeded in unearthing, amongst a number of gems, two diamonds of the first water, and a green sapphire, which the Government geologist has pronounced to be a rarity, and, but for a cloud, is one of the most valuable yet discovered. In addition payable gold has been struck in patches. The discovery has created no little excitement throughout the district, and numbers of people have already visited the locality, which lies a few miles from the Nepean river, and about 7 miles from Mittagong. A recent visitor there reports that a lot of land has already been taken up, and that further results respecting the prospects of the place are anxiously awaited. The men have had great difficulty in keeping back the water, which necessitated the construction of a dam and the cutting of races for quite ½ of a mile to carry off the overflow. So far the means used for washing are of the most primitive type, and as a big wash-up from some new ground is soon to be made, more modern and suitable appliances than the old sluice-box will probably be adopted to ensure the success of the place as a diamond field.

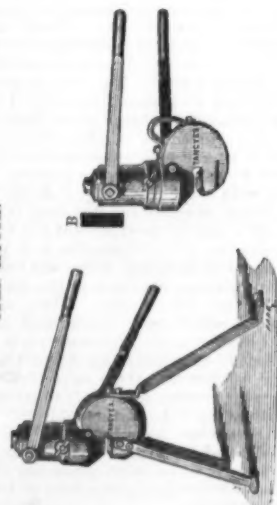
CALIFORNIAN MINING MUSEUM.—At the University of California, Berkeley, they are doing good work in collecting, identifying, and arranging the rocks, ores, and minerals of the coast. The Museum of Petrography contains many foreign rocks; but is especially rich in California material, collected by the corps of the State Geological Survey and Mr. C. D. Voy. The rocks, says the San Francisco Mining and Scientific Press, are being arranged systematically and geographically, so that, as the collection becomes more complete, the geographical distribution of the rocks of the Pacific Coast will be known with great accuracy and detail. It is designed to issue as soon as possible a descriptive catalogue of the rocks of California. The Museum of Economic Geology, although so recently founded, is already large, and is in frequent receipt of valuable acquisitions from all parts of the State. The importance and value of this collection can scarcely be over-estimated. It will subserve two purposes:—On the one hand, it renders possible a course of instruction in ore deposits, which is of essential importance to those who intend to pursue the profession of mining engineer; and, on the other hand, the ore deposits of this coast will be collected together for the first time in one institution, where they can be subjected to careful and critical comparative investigation, in order that the laws of their occurrence may, as far as possible, be determined. To this end an elaborate blank-book has been devised, in which are carefully tabulated the name, locality, form, thickness, dip, strike-slip, &c., of every ore deposit on the coast, as soon as accurate information upon these points can be obtained. The mass of statistics thus obtained will be made the basis of the above-named investigations. The Museum of Mineralogy is very large and fully arranged, and is supplied with ample case-room. It fully illustrates the instruction in mineralogy, and offers inexhaustible material for investigation, facilities for which are freely placed at the disposal of the student. Mr. A. W. Jackson, the instructor in mineralogy, petrography, and economic geology is an enthusiast in these special branches, and has taken great trouble in the collection, identification, and arranging of the specimens. All of the museums are open at all times to the public. Mr. Rivers being in constant attendance to show visitors through the various collections. Miners who come to the city will find much to instruct and amuse them by a visit to these collections.

GREAT WHEAL POLGOOTH COMPANY.—In the Chancery Division of the High Court of Justice, Vice-Chancellor Sir James Bacon resumed, on Nov. 22, the hearing of the adjourned summons taken out by the official liquidator of this company, and praying for a declaration that Sir William Edward Douglas Croasie, Bart., Henry Sedgewick Wilde, Major Edward Francis Knotesford Fortescue, and John Hunter Stephenson, directors of the company, were guilty of gross negligence, misfeasance, and breach of trust in relation to the payment of a sum of 15,446l. to Ledru Rollin Reynolds, the promoter of the undertaking, and were jointly and severally liable for that sum, as for any losses sustained by the company by reason of the negligence and breach of trust. The Vice-Chancellor said he should be very sorry to have it supposed that he did not consider directors of a company liable for negligence, but then that negligence must be proved to the satisfaction of the Court. The summons no doubt charged the defendant with gross negligence, misfeasance, and breach of trust, but in the opening of the case the imputation of fraud had been dealt with very cautiously. As to the first branch of the summons which charged the directors, in relation to a contract of March 17, 1881, and in carrying out the same, and in paying large sums of money to L. R. Reynolds, and in allotting shares to him under the name of Anderson, there was not a particle of evidence to show that the respondents knew of the act of Reynolds in substituting another name for his own. Then, again, as to the charge of negligence (of which term the alleged misfeasance and breach of trust must be taken to be explanatory), in resisting the application of two persons to have their names removed from the register, there was nothing to show that these respondents knew that the company was not a going concern and likely to go on. If these directors had been promoters, or if L. R. Reynolds had been a respondent to the summons, there would have been a different case to try. As it was the charges failed, and there would be no order on the summons, except an enquiry as to what sums any of the directors may have received (including especially a sum of 1000l. alleged to have been received by Stevenson) from the promoters of the company, and an order that they severally repay such sums respectively. There would be no order as to costs up to the hearing; the subsequent costs would be reserved.

TANGYES LIMITED CORNWALL WORKS

TANGYES' HYDRAULIC PUNCHING BEAR.

OPEN MOUTH.



This Bear is made in two forms—viz., with legs as A, or with handle instead of legs as B. The latter is largely used by Shipbuilders for punching ship frames. Distance from centre of punch to back of gap is 1 1/4 in. For extra depth of gap special quotation is necessary.

No.	To punch, iron plate.	Weight.	Price.
1	1/4 in.	44 lbs.	£7 10
2	1/2 in.	90 "	9 0
3	3/4 in.	120 "	10 10
4	1 in.	160 "	12 0
5	1 1/4 in.	220 "	16 0
6	1 1/2 in.	320 "	21 0
7	1 3/4 in.	440 "	28 0
8	2 in.	600 "	38 0

Price includes one Round Punch and Die.

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

To punch hole ... in.	Through iron plate.	Round.	Oval or square.	Weight.	Price.
1/4	1/4	1/4	1/4	1 1/4	1 1/4
1/2	1/2	1/2	1/2	2 1/2	2 1/2
3/4	3/4	3/4	3/4	4 1/4	4 1/4
1	1	1	1	6 1/4	6 1/4
1 1/4	1 1/4	1 1/4	1 1/4	10 1/4	10 1/4
1 1/2	1 1/2	1 1/2	1 1/2	14 1/4	14 1/4
1 3/4	1 3/4	1 3/4	1 3/4	18 1/4	18 1/4
2	2	2	2	22 1/4	22 1/4

A Pair means One Punch and One Die.

Intermediate sizes charged at price of next larger size.

144

TANGYES' HYDRAULIC PULLING JACK.



In this Jack the Pump is inside and out of the reach of damage from accidents. The run out can be increased to a moderate extent without increasing size of cylinder.

Tested to ... tons.	Run out ... ins.	Weight ... lbs.	Price ...
2	24	24	24
4	48	48	48
6	72	72	72
8	96	96	96
10	120	120	120

INSTRUCTIONS FOR USING THE PULLING JACK.

After filling it with water, which can be poured in through the air screw, suspend it with the clatern end downwards, screw up the stop valve and work the hand lever; the water will then be pumped from the clatern through the inner tube to the underside of the piston, thus impelling it forward, and at the same time the water from the back of the piston is constantly flowing through the passages indicated to supply the clatern. TO LOWER, open the stop valve, when the water will return to the clatern.

TANGYES' HYDRAULIC TIMBER JACK.

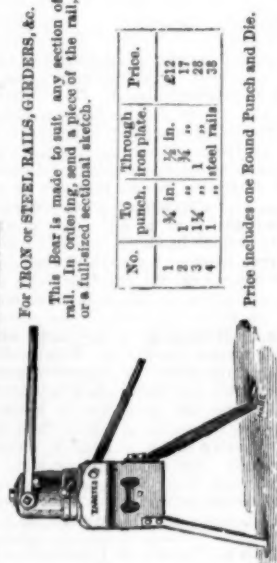


Tested to ...	Height ...	Run out ...	Weight ...	Price ...
4 tons.	14 in.	7 in.	7 in.	7 in.
14 in.	7 in.	7 in.	7 in.	7 in.
7 in.	7 in.	7 in.	7 in.	7 in.
7 in.	7 in.	7 in.	7 in.	7 in.

142

TANGYES' HYDRAULIC PUNCHING BEAR.

CLOSE MOUTH.



TANGYES' HYDRAULIC STEEL CABLE SHEARS.

This Tool was specially designed for cutting Steel Cable, which it does very effectively, making a clean cut. It may be used also for Shearing Iron Bars in the usual way.

No.	To cut iron bar.	To shear Steel Cable.	Price.
1	2 in. x 1/4 in.	1/4 in. diam.	£28
2	3 in. x 1/4 in.	3/8 in. "	35

Price includes one pair Blades.

Extra Shear Blades per pair, No. 1, £2; No. 2, £2 10s.

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

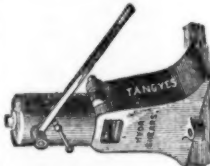
To punch hole ... in.	Through iron plate.	Round.	Oval or square.	Weight.	Price.
1/4	1/4	1/4	1/4	1 1/4	1 1/4
1/2	1/2	1/2	1/2	2 1/2	2 1/2
3/4	3/4	3/4	3/4	4 1/4	4 1/4
1	1	1	1	6 1/4	6 1/4
1 1/4	1 1/4	1 1/4	1 1/4	10 1/4	10 1/4
1 1/2	1 1/2	1 1/2	1 1/2	14 1/4	14 1/4
1 3/4	1 3/4	1 3/4	1 3/4	18 1/4	18 1/4
2	2	2	2	22 1/4	22 1/4

A Pair means One Punch and One Die.

Intermediate sizes charged at price of next larger size.

143

TANGYES' HYDRAULIC SHEARS.



No.	To cut iron square or round.	To cut iron bar.	Price.
1	1 1/2 in.	3 x 1/2 in.	£18 0
2	2 in.	4 x 1/2 in.	21 10

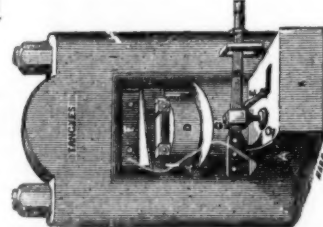
Weight: No. 1, 230 lbs.; No. 2, 350 lbs.

Extra Shear Blades per pair, No. 1, £2; No. 2, £2 10s.

These Shears can be adapted for power by attaching a joint pin to end of lever.

HYDRAULIC SHEARING MACHINE.

(Eastwood's Patent)



No.	To cut iron square or round.	Price.
1	2 1/2 in.	£42
2	3 in.	50
3	3 1/2 in.	65
4	4 in.	90

All with 10 in. gap, and two Pumps.

If made with separate Pump to be worked by power, extra.

If mounted on wheels extra.

143

TANGYES' "DUPLUX" LEVER PUNCHING BEAR.

This Bear is now made almost entirely of Steel.

OPEN MOUTH DUPLUX BEAR.

No.	To punch, iron plate.	Gap.	Weight.	Price.
1	1/4 in.	1 1/4 in.	18 lbs.	£3 10
2	1/2 in.	1 1/2 in.	38 "	4 10
3	3/4 in.	1 3/4 in.	81 "	6 10
4	1 in.	2 in.	120 "	10 10

Price includes one Round Punch and Die.

CLOSE MOUTH DUPLUX BEAR.

No.	To punch, iron plate.	Through.	Price.
1	1 1/4 in.	1/4 in. from rail	£47 10
2	1 1/2 in.	1/2 in. " steel "	"

Price includes one Round Punch and Die.

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

To punch hole ... in.	Through iron plate.	Round.	Oval or square.	Weight.	Price.
1/4	1/4	1/4	1/4	1 1/4	1 1/4
1/2	1/2	1/2	1/2	2 1/2	2 1/2
3/4	3/4	3/4	3/4	4 1/4	4 1/4
1	1	1	1	6 1/4	6 1/4
1 1/4	1 1/4	1 1/4	1 1/4	10 1/4	10 1/4
1 1/2	1 1/2	1 1/2	1 1/2	14 1/4	14 1/4
1 3/4	1 3/4	1 3/4	1 3/4	18 1/4	18 1/4
2	2	2	2	22 1/4	22 1/4

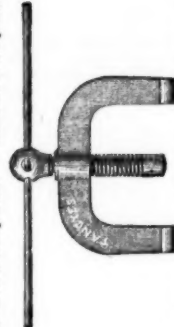
A Pair means one Punch and one Die.

Intermediate sizes charged at price of next larger size.

147

TANGYES' SCREW RAIL BENDER, OR "JIM CROW."

Made of best hammered Scrap Iron. Machine cut Square Thread Screw.



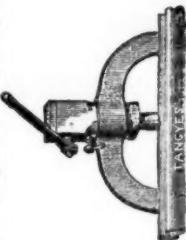
Size	No.	1	2	3	4
Price	£	2 10	3 10	5 0	7 0
Diameter of Screw		1 1/2 in.	2 in.	2 1/2 in.	3 in.
Span		16 in.	20 in.	24 in.	28 in.
To bend Iron Rails up to, per yd.		30 lbs.	50 lbs.	90 lbs.	150 lbs.
" Steel Rails " " " "		20 "	45 "	65 "	90 "
Weight		approx. 60 "	96 "	140 "	180 "

This Bender can be made to suit any section of Train Rail.

TANGYES'

HYDRAULIC RAIL BENDER, OR "JIM CROW."

Made of best hammered Scrap-Iron. Can be worked in any position.



Size	A	B	C
Price	7	9	11
To bend Iron Rails up to per yard.	50 lbs.	90 lbs.	90 lbs.
" Steel Rails " " " "	45 " 100 "	65 " 150 "	200 "
Weight	approx.		

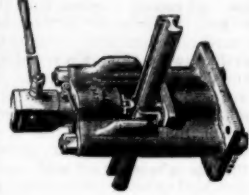
This Bender can be made to suit any section of Train Rail.

When ordering, a section of the rail should be sent.

148

TANGYES'

STANDARD HYDRAULIC PUNCHING MACHINE.



No.	Gap.	To punch, iron plate.	Through iron plate.	Weight.	Price.
1	1 in.	1 in.	1 in.	4 cwt.	£25
2	1 1/2 in.	1 1/2 in.	1 1/2 in.	7 "	30
3	2 in.	2 in.	2 in.	10 "	38

Price includes one Round Punch and Die.

TANGYES' SCREW PUNCHING BEAR.



No.	To punch, iron plate.	Through iron plate.	Weight.	Price.
1	1/4 in.	1/4 in.	23 lbs.	40/-
2	1/2 in.	1/2 in.	38 "	50/-
3	3/4 in.	3/4 in.	51 "	75/-

Price includes one Round Punch and Die.

If with Ratchet Lever, extra 12/-

" Plain " " 5/-

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

To punch hole ... in.	Through iron plate.	Round.	Oval or square.	Weight.	Price.
1/4	1/4	1/4	1/4	1 1/4	1 1/4
1/2	1/2	1/2	1/2	2 1/2	2 1/2
3/4	3/4	3/4	3/4	4 1/4	4 1/4
1	1	1	1	6 1/4	6 1/4
1 1/4	1 1/4	1 1/4	1 1/4	10 1/4	10 1/4
1 1/2	1 1/2	1 1/2	1 1/2	14 1/4	14 1/4
1 3/4	1 3/4	1 3/4	1 3/4	18 1/4	18 1/4
2	2	2	2	22 1/4	22 1/4

A Pair means one Punch and one Die.

Intermediate sizes charged at price of next larger size.

146

TANGYES' HYDRAULIC SHAFT STRAIGHTENER.

For Straightening Shafts in the Lathe.



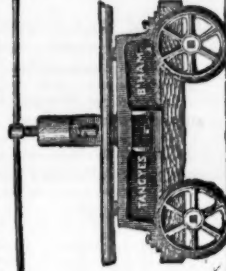
A bar passing through an eye in each of the Shafts, not shown in engraving, is supplied and secured by means of Pulley Blocks, on and off the Lathe.

Diam. Shaft.	Will take Shafts.	Weight.	Price.
3 1/2 in.	3 in. diam.	2 cwt.	£18
4 in.	4 in. "	3 1/2 "	22
5 in.	5 in. "	5 "	30

Price includes Straps.

TANGYES'

IMPROVED RAIL STRAIGHTENER.



No.	To bend Steel Rails.	To bend Iron Rails.	Price.
1	45 lbs. per yd.	60 lbs. per yd.	£18
2	90 "	90 "	25

In ordering state gauge of rails, or if required for roads.

Copyright.—Entered at Stationers' Hall.

149

MINING MACHINERY, MILLING MACHINERY

Of the MOST APPROVED AMERICAN PATTERNS.

GOLD MILLS.

The California pattern of Gold Stamp Mill is universally accepted as the most perfect, economic, and efficient made. We have over 900 stamps in successful work in the various Western Gold Districts.

SILVER MILLS.

Silver amalgamation in Pans is essentially an American system evolved after years of work on the rich silver mines of Nevada.

We have over 500 Stamps, with necessary pans, settlers, roasting furnaces, &c., all of our own manufacture, at work in different silver camps of the United States, Mexico, and South America, and Philippine Islands, Asia.

CONCENTRATION MILLS

Of the most approved German pattern and arrangement, or with Stamps and Frue Vanner Concentrators for low grade silver ores, light in lead. We have over 20 large German pattern mills at work on lead, zinc, or copper ores, and numerous Vanner mills on ores never before successfully concentrated.

Mining Pumps, Cornish pattern, of the largest sizes. Hoisting Engines, from 4 h.p. up to the largest direct-acting engines to sink 3000 feet.

SMELTING WORKS.

We have 80 Water Jacket Smelting Furnaces in use from 20 in. circular up to 54 in. by 60 in. for lead and silver smelting; and special High Jacket Furnaces for copper ores.

Engines of any size, plain slide valve, Corliss, compound Corliss, Boilers, all sizes. Leaching Mills, Hallidie Wire Rope Tramways, Comet Crusher, with capacity of 12 to 20 tons per hour. White, Howell, Bruckner, and Stetefeldt Roasting Furnaces, &c.

We have had twenty years experience in the manufacture solely of MINING MACHINERY, and have special facilities for shipping to all foreign parts through our New York Office, where all details of clearance, shipment, and insurance are conducted. Our machinery is already well known in Mexico, Peru, Chili, Venezuela, Honduras, and other South American countries.

Correspondence solicited. Descriptive Circulars and Catalogues on application

FRASER AND CHALMERS.

PRINCIPAL OFFICE AND WORKS.

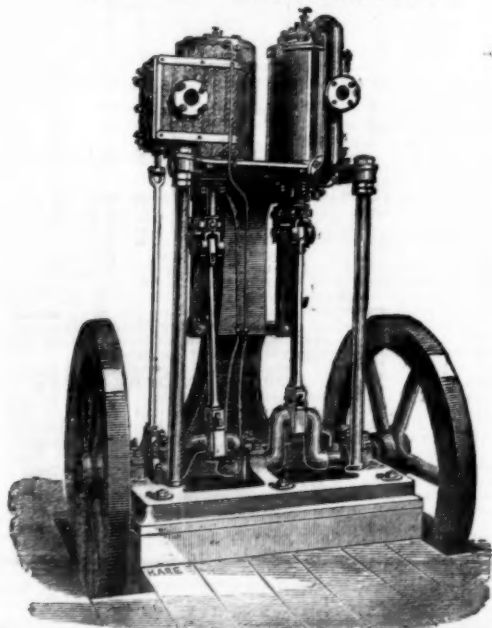
NEW YORK OFFICE.

Fulton and Union Streets,
Chicago, Ill., U.S.

No. 2, Wall Street,
New York, U.S.

COLORADO OFFICE—CHEESMAN BLOCK, DENVER.

THE "Champion" Rock-borer AND AIR COMPRESSOR.



As an instance of the actual work done by this Machinery in various kinds of ground, some of it the hardest rock, it may be mentioned that in Cornwall, irrespective of the work performed by the "Champion" Rock-borers and Air-compressors purchased by various Mines, the drivage, rising, sinking, and stoping done by contract by the Proprietor with his own Machinery now amounts to over 1350 fathoms.

Several of these Air-compressors, ranging from 3½ to 12 tons in weight may be seen in constant work in the Camborne Mining District.

R. H. HARRIS,

ENGINEER,

63, QUEEN VICTORIA STREET, LONDON.

KIRKSTALL, BOWLING, AND STAFFORDSHIRE BAR IRON

RAILS—RAILS—RAILS—

New, slightly defective.

F.B. SECTION—BULL HEAD—DOUBLE HEAD—

10, 12, 14, 16, 18, 20, 24, 30, 40, 60, 70, 75, 80 lb. per yard.

Sections on application to

WILLIAM FIRTH, WATER LANE, LEEDS.

POINT and CROSSINGS with all Fittings complete.

1000 tons in stock ready for delivery.

CLAYTON AND SHUTTLEWORTH, STAMP END WORKS, LINCOLN, AND 78, LOMBARD STREET, LONDON.

The Royal Agricultural Society of England have awarded Every First Prize to CLAYTON and SHUTTLEWORTH for Portable and other Steam Engines since 1863, and Prizes at every Meeting at which they have competed since 1849.



GOLD MEDAL AND FIRST CLASS CERTIFICATE at the Calcutta International Exhibition 1883-4.

THE ONLY GOLD MEDAL

AWARDED FOR

PORTABLE STEAM ENGINES.

Steam Engines, portable & fixed,

For Coals, Wood, Straw, and every kind of Fuel.

OVER 21,500 SOLD.

Thrashing Machines.

OVER 19,500 SOLD.

Straw, Corn, and Hay Elevators.

Chaff Cutters for Steam Power.

Grinding Mills.

Saw Benches.

Traction Engines, &c.

GOLD MEDALS AND OTHER PRIZES have been awarded to CLAYTON AND SHUTTLEWORTH at all the important International and Colonial Exhibitions, including LONDON, 1861 and 1862; PARIS, 1855, 1867, and 1878; VIENNA, 1857, 1866, and 1873.

Catalogues in English and all European Languages free on application.

THOMAS TURTON AND SONS, MANUFACTURERS OF Cast Steel for Mining and other Tools, Shear, Blister, and Spring Steel. FILES OF SUPERIOR QUALITY.

EDGE TOOLS, HAMMERS, PICKS, AND ALL KINDS OF TOOLS FOR RAILWAYS, COLLIERIES, ENGINEERS, AND CONTRACTORS
LOCOMOTIVE ENGINE, RAILWAY CARRIAGE, AND WAGON SPRINGS AND BUFFERS.

SHEAF WORKS, AND SPRING WORKS, SHEFFIELD.

LONDON OFFICES:—90, CANNON STREET, E.C.

POTENTITE.

This unrivalled Explosive, as manufactured by the New and Perfected Machinery of the Company, is perfectly safe for transit, storage, and use, and is employed in every description of Mining or Quarrying Work, for Tunnelling, Pit Sinking, Engineering Work, and Submarine Operations, with the most complete success and satisfaction.

Potentite does NOT contain its own MEANS OF IGNITION, is free from Nitro-Glycerine, and its SAFETY has been specially demonstrated by public experiments.

Its strength is unequalled.

Its action is certain.

In action it gives off neither flame, smoke, nor offensive smell. By its use labour is economised, as work can be resumed immediately after the shot is fired.

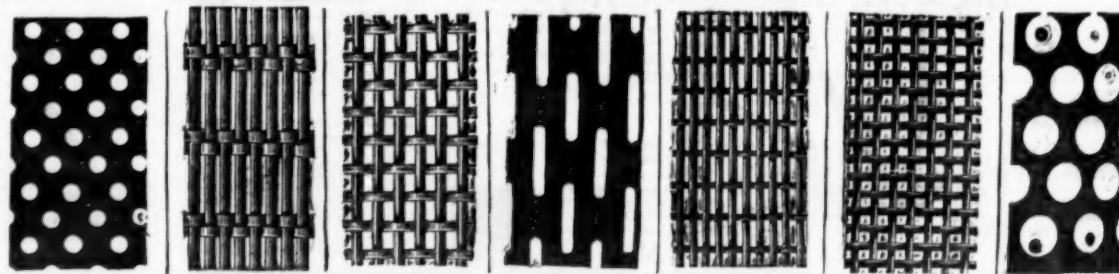
POTENTITE is specially adapted for export to hot climates, as it is unaffected by heat, and is free from dangerous exudations.

POTENTITE IS THE SAFEST STRONGEST, AND WORK FOR WORK, CHEAPEST EXPLOSIVE IN THE MARKET.

For particulars and prices, apply to—

THE POTENTITE COMPANY, LIMITED.

HEAD OFFICE—3, FENCHURCH AVENUE, LONDON, E.C.



Extra Treble Strong Wire Cloth and Perforated Metals in Steel, Iron, Copper, Brass, Zinc, Bronze.

Made in all Meshes and Widths.

N. GREENING & SONS, Limited,

Wire Manufacturers and Metal Perforators,

WARRINGTON.

Jigger Bottoms, Trommels, Cylinder Covers, Riddles, Sieves for Diamond, Gold, Silver, Copper, Lead and Tin Mines.

Samples and Prices free on application.

FRANCIS MORTON AND CO., LIMITED, LIVERPOOL,

MANUFACTURERS OF

GALVANISED CORRUGATED IRON ROOFS, BUILDINGS, AND SHEDDING,

WHICH THEY HAVE EXTENSIVELY ERECTED FOR THE REQUIREMENTS OF

Forges, Rolling Mills, Puddling Sheds, Ironworks, and Collieries

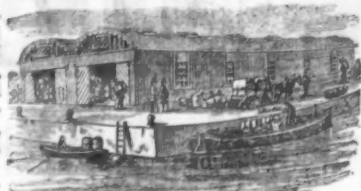
Erected Complete in this Country, or prepared to Plan for Erection Abroad.



OPEN SHED FOR COVERING LARGE AREAS

GALVANISED OR PAINTED CORRUGATED IRON ROOFING PLATES and TILES. HEAVY CORRUGATED IRON PLATES for fireproof floors, roadways, parapets, &c. (for producing which F. M. and Co. have recently laid down powerful Hydraulic Machinery). Wrought-iron Tanks, Guttering, and General Constructional Wrought Ironwork.

DESIGNS PREPARED, AND ILLUSTRATED DESCRIPTIVE CATALOGUES FORWARDED ON APPLICATION



GENERAL STORE FOR WHARF, ETC.

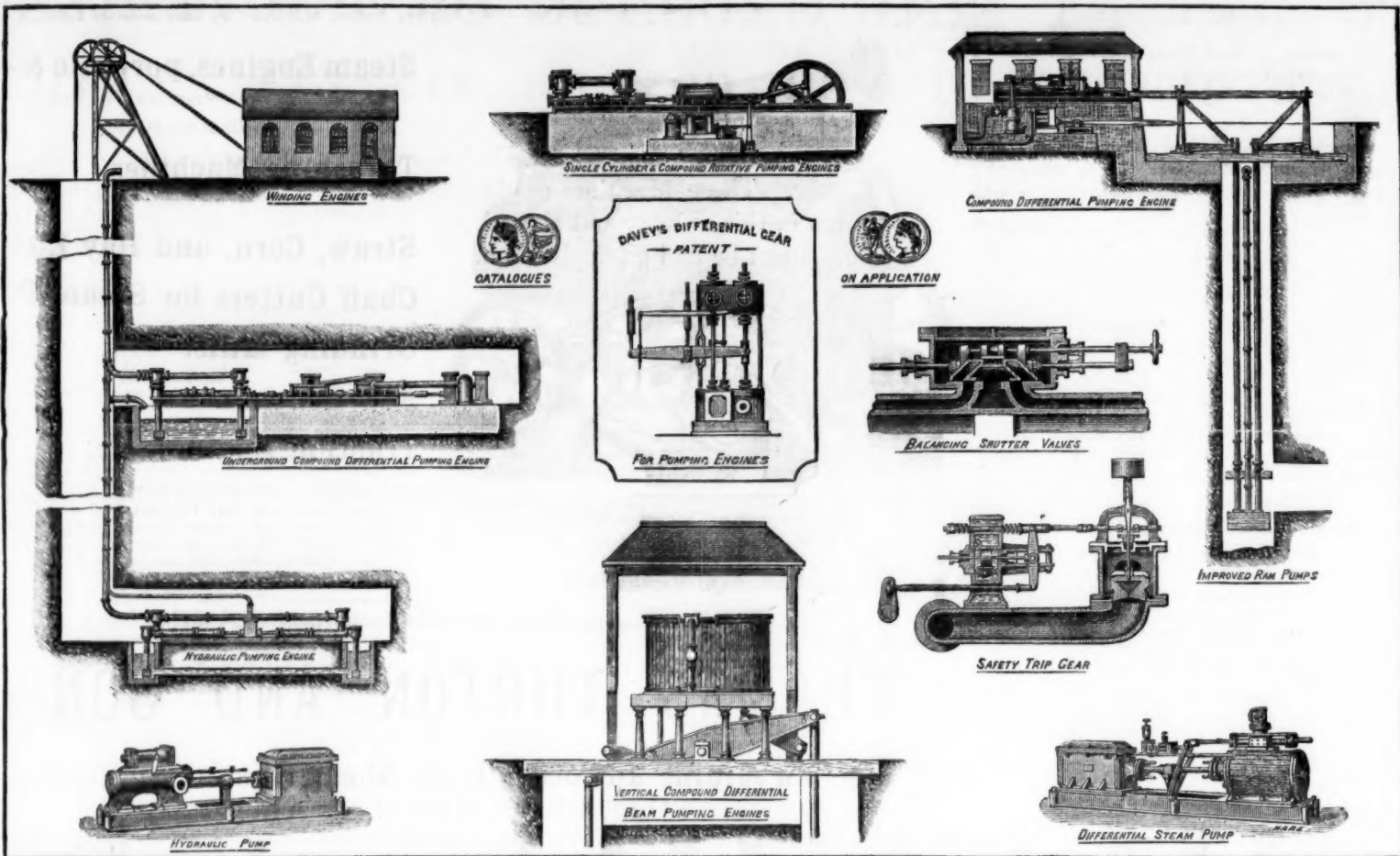
London Office: 9, Victoria Chambers, Victoria Street, Westminster, S.W.

(Rooms Nos. 27 and 28, on the First Floor.)

HATHORN, DAVEY & CO.,

PUMPING MACHINERY.

MINING MACHINERY.



SUN FOUNDRY, LEEDS.

BELL'S ASBESTOS.

BELL'S PATENT ASBESTOS BLOCK PACKING for High-Pressure Engines
The following testimonials refer to this Packing:—

Mona Lodge, Amlwch, Anglesey,
2nd August, 1884.
DEAR SIR,—I have much pleasure in answering your note. Bad times in mining have compelled me to try all kinds of expedients in order to effect saving; some have succeeded and some have failed, but my underground manager, Capt. Hughes, has just said to me by the telephone—“The Asbestos Packing is the best thing ever brought here.” It saves money and trouble, but like my gas purifying oxide it lasts so long that you must not expect another order from me for twelve months at least.
Yours truly,
T. P. EVANS,
Late H.M. Inspector of Metalliferous Mines.
Manchester, Sheffield, and Lincolnshire Railway—Steamship Department,
Grimsby, April 10th, 1884.
DEAR SIR,—I have much pleasure in stating that after a trial of over nine months, and comparing it with other packings, I can confidently recommend your Asbestos Packing. It is especially valuable when high-pressures are employed, as in cases where other packings have perished, owing to high temperatures, your packing has invariably stood well. I have also used it with complete success when a gland has heated with other packings, and also in cases of badly scored piston rods. I consider the results I have obtained by its use for our marine engines to have been in every way highly satisfactory.
Yours truly,
G. H. CLARKE, Sup. Engineer.
Department of the Director of Navy Contracts,
Admiralty, Whitehall, 20th June, 1884.

SIR,—I have to inform you that your tender has been accepted for Bell's Rolled Cloth Asbestos Packing to sample submitted:—Elastic core Square.
To Mr. John Bell.
The Patent Block Packing is square, as Fig. 1 and Fig. 2 and 3 represent the Round Block Packing with solid and hollow rubber core, and Fig. 4 without core, but with rubber inside. As these packings are extensively imitated, and as it is a common practice among dealers and agents to supply the cheaper manufactures at my list prices, users are requested to see that the packing supplied to them bears the trade mark.

BELL'S ASBESTOS BOILER PRESERVATIVE.—This useful mixture by absorbing the free oxygen that is in the water entirely checks pitting and corrosion. It also disintegrates incrustation so immediately as to prevent its adhering to the plates. Not only is a great economy of fuel effected by keeping boilers clean, but the risk of having the plates burned is thereby obviated. It has been computed that $\frac{1}{4}$ in. thick of incrustation causes a waste of 15 per cent. of coal; $\frac{1}{2}$ in., 40 per cent.; $\frac{3}{4}$ in., 150 per cent. Thus the Preservative avoids the great risks which are inseparable from scaled plates, lengthens the life of a boiler, and covers its own cost a hundred-fold by economy of fuel. It is entirely harmless, and has no injurious action on metals. It can be put into the feed tank or boiler, as may be most convenient. Sold in drums and casks bearing the Trade Mark, without which none is genuine.

BELL'S ASBESTOS YARN and SOAPSTONE PACKING for Locomotives and all Stationary Engines running at very high speed with intense friction.
Handwell Park Colliery, Smethwick, 1st February, 1884.

To Bell's Asbestos Works.
DEAR SIR,—I have much pleasure in stating that I have used your Asbestos Packing for the last 15 months for our large winding engines which are running night and day, and also for the fan, pumping, and hauling engines at the above Colliery, and during that period we have not used more than one-third the Packing we had formerly; and this I attribute to your Packing on account of its great durability and general excellence of quality.—I am, dear Sir, yours faithfully,
THOMAS WINTER, Colliery Engineer.



BELL'S ASBESTOS.
The goods of this house are of the highest quality only, and no attempt is made to compete with other manufacturers by the supply of inferior materials at low prices. All “home” orders should be sent direct to the undermentioned depôts and not through Agents or Factors.

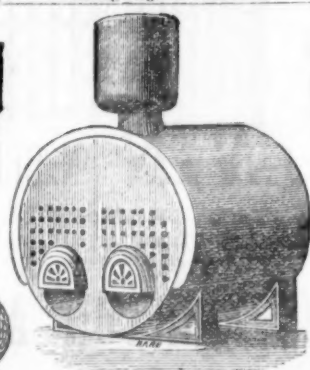


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

BELL'S ASBESTOS BOILER AND PIPE COVERING COMPOSITION, for coating every class of steam pipes and boilers, non-combustible and easily applied when steam is up; adheres to metals and preserves them from rust; prevents the unequal expansion and contraction of boilers exposed to weather; covers 50 per cent. more surface than any other coating, and is absolutely indestructible. It can be stripped off after many years' use, mixed up with 20 per cent. of fresh, and applied again. The composition is supplied dry, and is only to be mixed with water to the consistency required for use.

A Horizontal Boiler, 17 ft. 6 in. long, 15-H.P., gave the following results:—
Temperature on Plates - - - 188 deg.
Covering - - - 94 deg.
One ton of coal was saved per week, and although the fire was raked out every evening 20 lbs. of steam were found in the boiler next morning.

The following Testimonials refer to this Covering:—
Offices of the Wimbledon Local Board, Wimbledon, Nov. 28th, 1883.
DEAR SIR,—It may interest you to know that we save exactly 40 per cent. in fuel through using your covering.
Yours truly, W. SANTO CRIMP, C.E., F.G.S.

The Tamar and Kit Hill Granite Company (Limited),
Mr. John Bell, Southwark, S.E.
SIR,—I have much pleasure in stating that the Asbestos covering applied by you to the boiler of our travelling crane at Kit Hill has yielded most remarkable results. Since it has been in use we have saved fully half our coals, and have effected a great saving in the time it takes to get up steam, which is often a matter of great importance to us. I should add that the crane runs on high gantries, and is fully exposed to all weather. I have formed the highest opinion of your Asbestos as used for this purpose, and as you are aware, have had another boiler similarly covered, though it has not since been used. I can most strongly recommend the material.
I am, Sir, yours faithfully, W. J. CHALK, Assoc. M.Inst. C.E., Engineer and Manager.

BELL'S ASBESTOS and INDIA-RUBBER WOVEN TAPE and SHEETING, for making every class of Steam and Water Joints. It can be bent by the form required without puckering, and is especially useful in making joints of manhole and mudhole doors. It is kept in stock in rolls of 100 ft., from $\frac{1}{4}$ in. to 3 in. wide, and any thickness from $\frac{1}{4}$ in. upwards. Manhole covers can be lifted many times before the renewal of the jointing material is necessary. The same material is made up into sheets about 40 in. square, and each sheet bears the Trade Mark, without which none is genuine. It is very necessary to guard against imitations of this useful material, and to secure themselves against being supplied with these inferior articles at my price, users are recommended to see that every 10 ft. length of the Asbestos Tape purchased by them bears the Trade Mark.

BELL'S SPECIAL LONDON-MADE ASBESTOS MILLBOARD, for Dry Steam Joints, made of the best Asbestos fibre, is well-known for its toughness and purity, and is absolutely free from the injurious ingredients frequently used to attain an appearance of finish, regardless of the real utility of the material. Made in sheets measuring about 40 in. square, from 1-64th in. to 1 in., and $\frac{1}{2}$ millimetre to 25 millimetres thick. Each sheet bears the Trade Mark.

The following copy of acceptance of tender refers to above:—
Department of the Director of Navy Contracts,
Admiralty, Whitehall, S.W., 17th May, 1884.

SIR,—I have to inform you that your tender for Asbestos Millboard has been accepted.—Mr. John Bell.

JOHN COLLETT, Director of Navy Contracts.
BELL'S ASBESTOS EXPANSION SHEETING (PATENT). This Sheeting is another combination of Asbestos with India-rubber, giving to the steam user the special advantages of both materials. The India-rubber Washer is protected from the action of heat and grease by an outer coating of vulcanised Asbestos Cloth, thus producing an excellent joint where expansion and contraction render other materials unserviceable. This material is admirably suited to steam pipe joints and every class of valve. Valves made of this material are very durable, as they are not subject to injury by oil.

BELL'S "ASBESTOS LUBRICANT"

"REGD."

ILLUSTRATED PRICED CATALOGUE FREE ON APPLICATION TO

BELL'S ASBESTOS WORKS, SOUTHWARK, LONDON, S. E.

OR THE DEPOTS—118a, SOUTHWARK STREET, S.E.

Victoria Buildings, Deansgate, MANCHESTER.

11 and 13, St. Vincent Place, GLASGOW.

39, Mount Stuart Square, CARDIFF.

21, Ritter Strasse, BERLIN.

THE BLAKE-MARSDEN NEW PATENT IMPROVED STONE BREAKERS AND ORE CRUSHERS.

ORIGINAL PATENTEE
AND ONLY MAKERALSO PATENTEE AND ONLY
MAKER OF THE**H. R. MARSDEN,**
NEW PATENT FINE CRUSHER OR PULVERIZER,

FOR REDUCING TO AN IMPALPABLE POWDER, OR ANY DEGREE OF FINENESS REQUIRED.

GOLD QUARTZ, SILVER, COPPER, TIN, ZINC, LEAD

AND ORES OF EVERY DESCRIPTION

PATENT REVERSIBLE CUBING and CRUSHING
JAWS, IN FOUR SECTIONS,
WITH PATENT FACED BACKS, REQUIRING
NO WHITE METAL IN FIXING.CRUCIBLE CAST-STEEL CONNECTING RODS.
RENEWABLE TOGGLE CUSHIONS, &c.**OVER 4000 IN USE.**EXTRACTS FROM TESTIMONIALS.
PULVERIZER.

"I have great pleasure in bearing testimony to the merits and capabilities of your patent combined fine crusher and sieving apparatus. I have tried it on a variety of ores and minerals, and it pulverizes them with equal success. You can put in a small paving stone and bring it out like flour."

"In reply to your favour, I have much pleasure in informing you that the 12x3 Pulverizer we had from you is giving us every satisfaction. The material we are operating on is an exceptionally hard one. I am well satisfied with its working."

"Our experience is that the motion and mechanical arrangements of your machine are the best for pulverizing that we have ever met with."

"The reports from our mines as regards the working of your Fine Crusher (20x5) recently supplied are very favourable, although we cannot quote you exact figures. On being got into position it was tried by hand, with the result that it made short work of the biggest pieces of ore we put into the hopper. You might say how long you would take to deliver another of the same size."

"As I once before stated, your machine is a perfect pulverizer." "I am sure the machine will be a success, and a great one, and there is any amount of demand for such a machine. We can work it with 20 lbs. of steam, and our engine, which is a 12-h.p., plays with the work, in fact we run the Stonebreaker and the Pulverizer both together with 35 lbs."

Also Cement, Barytes, Limestone, Chalk, Pyrites, Coprolite, &c., &c. These Machines are in successful operation in this country and abroad, and reference to users can be had on application.

AWARDED OVER

60

FIRST-CLASS GOLD AND SILVER MEDALS.

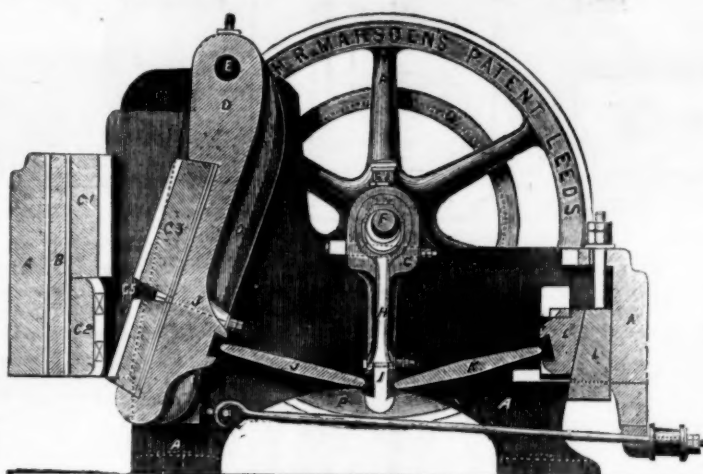
ADOPTED BY THE PRINCIPAL CORPORATIONS, CONTRACTORS, MINING COMPANIES, &c., IN ALL PARTS OF THE WORLD.

ROAD METAL BROKEN EQUAL TO HAND, AT ONE-TENTH THE COST.

EXTRACTS FROM TESTIMONIALS.—STONEBREAKER.

"I now order Three of your Stone Crushers, size 15 x 10, to be of your very best construction, and to include two extra sets of Jaws and Cheeks for each. The last two 24x13 machines you sent me, which are at work in this colony, are doing very well. You will soon find that the railway contractors will adopt your machines in preference to the colonial ones—two of which I have. I know other contractors have had as many as nine of them, which have not given very good satisfaction. Once they know of yours thoroughly, I believe you will do a good trade with the colonies. For reference of the high character of your constructions you can refer to me as having used them with the very best results, both in New Zealand and this colony, and much prefer them to the colonial article, both in point of construction and less liability to go out of order. The material we are crushing is very hard blue stone, for railway ballast purposes. Push on with the order as quickly as possible; I do not think it necessary to have any engineering inspection. I have brought your machines prominently under the notice of all large contractors in this colony, likewise the Government. Many of the contractors have spoken to me in reference to their capabilities, and I could only tell them that they are by far and away the best and most economical I ever used. The very fact of me having purchased now Eleven from you at various intervals and various sizes, and two above 12 years ago, and having tried all the other makers, is sufficient guarantee of the capabilities and the working of your machines. Yours in every way surpass all others."

"Some of your testimonials do not give your machines half their due. I have seen men hammering away on a big rock for a quarter of a day which your machine would reduce to the required size in a quarter of a minute. I would guarantee that your largest size machine would reduce more of the Cornish tin caps (which is the hardest rock of England) in a day than 200 men, and at 1-25th the cost."



GREATLY REDUCED PRICES ON APPLICATION.

FOR CATALOGUES, TESTIMONIALS, &c., APPLY TO THE SOLE MAKER,

H. R. MARSDEN, SOHO FOUNDRY, LEEDS.**JOHN CAMERON'S**

FLY-WHEELS ON BOTH SIDES.

STEAM PUMPS
FOR
COLLIERY PURPOSES.

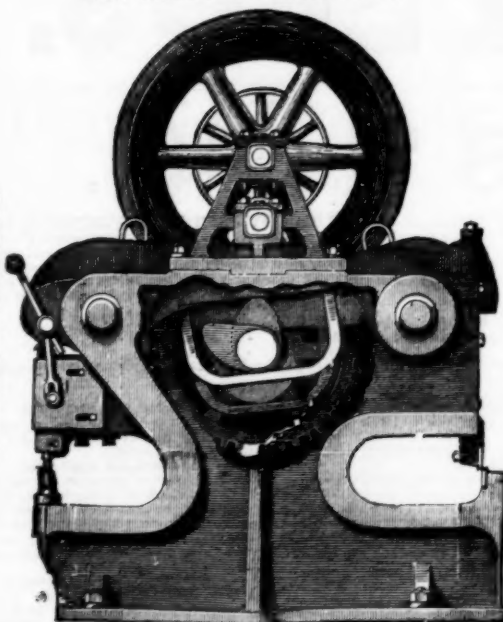
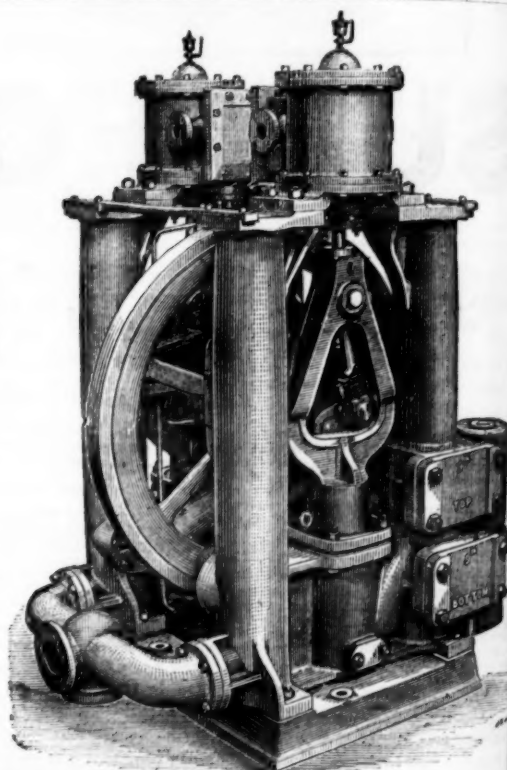
Specially adapted for forcing Water any height

ALSO, FOR

**SINKING, FEEDING BOILERS AND STEAM
FIRE ENGINES,**

Of which he has made over 9000.

ALSO, HIS

**PATENT CAM AND LEVER
PUNCHING & SHEARING MACHINES.****Works: Oldfield Road, Salford,
Manchester.**AGENTS { For LONDON and DISTRICT—PRICE and BELSHAM,
52, QUEEN VICTORIA STREET, E.C.
For NEWCASTLE and EAST COAST—E. BECKWITH AND CO.,
BONNERSFIELD, SUNDERLAND.

DISENGAGING APPARATUS.



By a special method of preparation this leather is made solid, perfectly close in texture, and impermeable to water; it has, therefore, all the qualifications essential for pump buckets, and is the most durable material of which they can be made. It may be had of all dealers in leather, and of—

HEPBURN AND GALE, LIMITED,
TANNERS AND CURRIERS,
LEATHER MILL BAND AND HOSE PIPE MANUFACTURERS,
LONG LANE, SOUTHWARK, LONDON.
Prize Medals, 1851, 1855, 1878, for
MILL BANDS, HOSE, AND LEATHER FOR MACHINERY PURPOSES.**PERFORATED SHEET METALS**
FOR
TIN, LEAD, AND COPPER MINES,MILLERS, BREWERS, AND
MALSTERS,
COLLIERIES AND
QUARRIES,
COFFEE ROASTER
AND
SUGAR REFINERS.
ALDRED & CO.,
WORKS: PARKER STREET, ASHLEY LANE,
MANCHESTER.

ESTABLISHED 1825.

EDWIN LEWIS AND SONS,
Patent Tube Works, MONMORE GREEN and Britannia Boiler Tube Works, ETTINGSHALL
WOLVERHAMPTON.

MANUFACTURERS OF

Lapwelded & Buttwelded Wrought-iron, Steel, or Homogeneous Tube
FOR EVERY
COLLIERY OR MINING PURPOSE.**J. WOOD ASTON AND CO., STOURBRIDGE**

(WORKS AND OFFICES ADJOINING CRADLEY STATION),

Manufacturers of

CRANE, INCLINE, AND PIT CHAINS,Also CHAIN CABLES, ANCHORS, and RIGGING CHAINS, IRON and STEEL SHOVELS, SPAD
FORKS, ANVILS, VICES, SCYTHES, HAY and CHAFF KNIVES, PICKS, HAMMERS, NAILS,
RAILWAY and MINING TOOLS, FRYING PANS, BOWLS, LADLES, &c., &c.

Crab Winches, Pulley and Snatch Blocks, Screw and Lifting Jacks, Ship Knees, Forgings, and Use Iron of all descriptions

**WELDED STEEL CHAINS { FOR CRANES, INCLINES, MINES, &c.,
MADE ALL SIZES.**